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A
Mechanical Account
OF
POISONS
In Several
ESSAYS.

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A
Mechanical Account
OF
POISONS
In Several
ESSAYS.

BY

RICHARD MEAD, *M. D.*

LONDON:
Printed by *R. J.* for **Ralph Smith**, at the
Bible, under the *Piazza's* of the *Royal-
Exchange, Cornhill.* 1702.

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THE

PREFACE.

T*O give an exact and particular Account of the Nature and Manner of acting of* Poiſons, *is no eaſie Matter; but to Diſcourſe more intelligibly of* Them *than Authors have hitherto done, not very difficult. One may without much Pains Shew their Effects to be owing to ſomething more than the bare Qualities of Heat or Cold; and Diſcover the Footſteps of Mechaniſm in thoſe ſurpriſing* Phænomena *which are commoly aſcribed to ſome* Occult *or Unknown Principle. But to Unravel the Springs of the ſeveral Motions upon which ſuch* Appearances *do depend, and Trace* *up all the Symptoms to their Firſt Cauſes, requires ſome Art as well as Labour; and that both upon the account of the Exquiſite Fineneſs, and marvellous Compoſition, of the Animal Machine in which they are Tranſacted, and of the Minuteneſs of thoſe Bodies which have the force to induce in It ſuch Sudden and Violent Alterations.*

I have attempted ſomewhat this way in the following Eſſays; *in which I do not promiſe Methodical, and Finiſh'd Treatiſes, but only ſome ſhort Hints of Natural Hiſtory, and Rude Strokes of Reaſoning, which if put together, and rightly Improved, may perhaps ſerve to furniſh out a more tolerable* Specimen *of the Doctrine of* Poiſons *than has yet bin Publiſhed.*

The Firſt Draught of this ſmall Piece I made ſome Years ſince, Entertaining my ſelf at Leiſure Hours with

with Experiments on Vipers, *and other* Venomous Creatures; *Examining now and then the Texture of* Arſenic, Mercury Sublimate, *and the like Malignant Subſtances; Turning over what Authors had ſaid on the ſeveral Subjects, and making ſuch Remarks as from time to time Occurr'd.*

Theſe continued Enquiries made up at laſt Three or Four ſhort Diſcourſes; which when I began to Digeſt into Order, the Increaſe of Buſineſs contracted the Intervals of my ſpare Time; and the Diverſion of ſuch Studies quickly giving way to the Severity of more neceſſary Labours, They were quite thrown by. Till Talking not long ſince with Dr. Areskine *concerning* the Viper, *I took occaſion to review my ſcattered Papers, and confirm my Reaſonings by new Experiments. He very readily offered Me His* Anatomical Obſervations,

ſervations, *which I have put at the End of the Firſt* Eſſay. *And* as *the Public does every Day Profit by his Application to this Part of Learning, which a wonderful Dexterity in* Cutting, *together with a True* Taſte *of Philoſophy and Phyſick, do declare Him Born to Improve and Advance to a far greater Pitch than It is yet arrived at;* ſo *Theſe few* Touches *of Art will, I doubt not, raiſe in the Reader a Deſire of ſeeing what He may ſome time or other expect, from the ſame Hand,* A Compleat Anatomy of Serpents.

My Deſign in Thinking of Theſe Matters was, to Try how far I could carry Mechanical Conſiderations in Accounting for thoſe ſurpriſing Changes which Poiſons *make in an Animal Body; Concluding (as I think fairly) that if ſo abſtruſe* Phænomena *as Theſe did come under the known Laws of Motion, It might very*

very well be taken for granted, that the more obvious Appearances in the ſame Fabrick are owing to ſuch Cauſes as are within the Reach *of Geometrical Reaſoning. And that therefore as the firſt Step towards the Removal of a Diſeaſe is to know Its Origin, ſo He is likely to be the beſt Phyſician, who having the ſame aſſiſtance of Obſervations and Hiſtories with Others, does beſt underſtand the* Humane Oeconomy, *The Texture of the Parts, Motions of the Fluids, and the Power which other Bodies have to make Alterations in any of Theſe.*

Nor indeed ought any One to Doubt of This, who conſiders that the Animal Compages *is not an irregular Maſs, and diſorderly Jumble of Atoms, but the Contrivance of Infinite Wiſdom, and Maſter-peice of that Creating Power, who has bin pleaſed to do all Things by Eſtabliſh'd*

Laws and Rules, and that Harmony *and Proportion ſhould be the Beauty of all his Works.*

It were therefore heartily to be Wiſh'd, that thoſe Gentlemen *who are ſo much afraid of* Introducing Mathematical *Studies, that is, Demonſtration and Truth, into the Practice of Phyſick, were ſo far at leaſt Inſtructed in the neceſſary Diſciplines, as to be able to paſs a true Judgment what Progreſs and Advances may be made this way; They would not then perhaps* Decry *an Attempt of ſo much Moment to the Welfare of Mankind, as vain and impoſſible, becauſe it is difficult, and requires Application and Pains.*

It is very evident, that all other Methods of Improving Medicine have bin found Ineffectual, by the Stand It has bin at theſe Three or Four Thouſand Years; and that ſince of late Mathematicians have *ſet Themſelves to the Study of It, Men do already begin to Talk ſo Intelligibly and Comprehenſibly, even about abſtruſe Matters, that it may be hoped in a ſhort time, if Thoſe who are Deſigned for this* Profeſſion, *are early, while their Minds and Bodies are Patient of Labour and Toil, Initiated in the Knowledge of* Numbers *and* Geometry, *that Mathematical Learning will be the Diſtinguiſhing Mark of a Phyſician from a Quack; and that He who wants this neceſſary Qualification will be as Ridiculous as One without* Greek *or* Latin.

I have, as to what regards the Animal Oeconomy, *Referr'd as much as I could to the Works of* Bellini, *which have brought great Light into the Dark Regions of Phyſick, and Taught Us to argue clearly and conſiſtently, inſtead of Amuſing our ſelves with Unintelligible Words or Precarious*

rious Hypotheſes. *The* Diſſertations *of Dr.* Pitcarne, *who is the Honour of his Profeſſion in* Scotland, *are a Convincing Proof of the Advantage of ſuch a Mechanical Way of Reaſoning; nor could* Malice *it ſelf deny This, were not* Ignorance *in Confederacy with It, which will ſecure any One from being Benefitted by the moſt uſeful Demonſtrations.*

Notwithſtanding This, I have bin forced now and then to make Digreſſions from my Subject, to clear ſome Doctrines neceſſary to be known which have not as yet bin Explained by Others. For indeed the Data *from which We argue in theſe Matters are by many too few.* Dr. Cheyne, *the Author of the* New Theory of Fevers, *has enumerated ſeveral Particulars in which the* Theoretic *Part of Medicine ſtill wants Improvement. If theſe* Deficiencies *were made good, We might with more Eaſe Proceed* *in our Enquires into Humane Nature. And therefore as This requires no leſs a* Genius *than his own, equally inſtructed in the moſt abſtruſe Parts of Geometry, and Thoſe other Studies which accompliſh a Phyſician*; ſo *it makes Us impatiently to Expect his* New Animal Oeconomy, *in which He will in a ſhort time, not only fully Illuſtrate ſeveral Things Hinted in the former* Treatiſe, *but Demonſtrate many of the Recited difficult Points; and Convince the World, that the moſt uſeful of Arts, if duly Cultivated, is more than either meer* Conjecture, *or baſe* Empiriciſm.

As to the Authors I have made uſe of, who have Treated of Poiſons, *I have Quoted only Thoſe who Furniſhed Me with Matter of Fact; For there are but few* Originals; *and very large Volumes on this Subject do many times contain little more than a Collection of* Vulgar Errors.

I had once Thought to have carried theſe Searches *farther; in Particular, beſides what is occaſionally mention'd in the laſt* Eſſay *concerning* Infection *in acute Diſeaſes, to have enquired into the Nature of* Contagious *and* Hereditary Diſtempers. *But the Humour of Scribbling would not hold out; And ſome perhaps will ſay, 'Tis well enough it didn't; For I am not Ignorant how Few I am like to Pleaſe; If it be hard to Think and Write Juſtly, 'tis harder yet to Bring Others to one's own* Taſte; *Nor ſhall I be at all Angry if to Many I have afforded Matter of* Satyr *and* Invective; *Leſs Wit ſuffices for Theſe than for the Diſcovery of Uſeful Truths. They who have no Smattering of* Mathematical *Knowledge, are incompetent Judges of what Service I have done towards the Improvement of the* Theory, *or* Practice *of* Medicine, *and Thoſe who are acquainted with theſe Matters, will, it may be, Think it ſomething to Talk Intelligibly on ſuch difficult and abſtruſe Points. I neither want* Applauſe, *nor fear* Cenſure; *and therefore be the Fate of Theſe Papers what it will, as they were firſt Penn'd for my own* Satiſfaction, *and Innocent* Entertainment; *ſo I am reſolved They ſhall never Ingage Me in the Trouble of* Quarrels *or* Diſputes.

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OF THE
VIPER.

THE Viper has always bin ſo Notorious for its Venom, that the moſt remote Antiquity made it an Emblem of what is Hurtful and Deſtructive. Nay, ſo terrible was the Nature of theſe Creatures, that they were very commonly thought to be ſent as Executioners of Divine Vengeance upon Mankind for Enormous Crimes, which had eſcaped the Courſe of Common Juſtice. Thus *Ælian* and *Herodotus* (*b*) do both take Notice that Adders were ſacred among the *Ægyptians*; that they affirmed of one ſort

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(*b*) Lib. 2. Chap. 74.

of 'em particularly, that they were made to be Miniſters of the Will of the Gods, by averting Evil from Good Men, and puniſhing the Bad. And *Pauſanias* (*c*) obſerves of the *Arabians*, that they forbore offering any Violence to the Vipers which were found near to the Balſam-Tree, as reputing 'em Holy. The Footſteps of which Superſtition do ſtill remain among theſe People to this very Day, for *Veſlingius* (*d*) ſaw many of 'em take theſe Creatures into their Houſes, feed 'em, and worſhip them as the *Genii* of the Place. The ſame odd Fancy obtains in the *Eaſt-Indies*, for the King of *Calicut* cauſes Cottages to be ſet up for Serpents to keep them from the Rain, and makes it Death to any that ſhall hurt one of 'em; thinking them to be Heavenly Spirits, becauſe they can ſo ſuddenly Kill Men (*e*). A remarkable Inſtance of ſuch an Opinion as this we have in the Hiſtory of St. *Paul*, (*f*) whom the People of *Malta* when they ſaw the Viper leap upon his Hand, preſently concluded to be a Murderer, and as readily made a

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(*c*) Bœotic. *p. m.* 303.
(*d*) Not. in Alpin. de Plant. Ægypt. Cap. 14.
(*e*) Purchaſe *his Pilgrimage*, l. 5. c. 12.
(*f*) Act. Apoſt. *Chap.* 28.

God of him, when inſtead of having his Hand Inflamed, or falling down Dead, (one or other of which is uſually the effect of thoſe Bites) he without any harm ſhook the Beaſt into the Fire. It being Obvious enough to imagine, that He muſt ſtand in a near Relation at leaſt to the Gods themſelves, who could thus Command the Meſſengers of their Vengeance, and Counterwork the Effects of ſuch powerful Agents.

And this, after the many Conjectures upon the Matter, ſeems to be the true Reaſon why Antiquity not only Repreſented the Firſt Maſters of Phyſick, *Hermes*, *Æſculapius*, *Hippocrates*, &c. in their Statues and Medals, with a Viper added to their Figure, but alſo Worſhipp'd them under this Form; for Diſeaſes in thoſe Days, eſpecially the moſt Violent, Plagues, Feavers, *&c.* were in like manner, as theſe Creatures, reputed the Commiſſion'd Meſſengers of Divine Anger and Diſpleaſure (*g*). They therefore who by their Art could Cure and Stop the Courſe of Theſe, as they were ſuppoſed to do this by the particular Leave

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(*g*) Leg. Cornel. Celſ. præfat. in Medicin. Morbos ait vetutiſſimis temporib. ad Iram Deorum immortalium relatos eſſe & ab iiſdem opem poſci ſolitam.

and Aſſiſtance of Heaven, ſo had Honours paid to Them accordingly, and this Repreſentation was in the Nature of an Hieroglyphick Character; for as the Learned *Spanhem* obſerves, (*h*) the Viper was a Symbol or Emblem of Divine Power.

Macrobius indeed gives us another account of this Cuſtom, and that is from the property which all Serpents have of caſting their *Exuviæ*, or Upper-Skin, every Year, which makes 'em fit Emblems or Repreſentations of Health; the Recovery of which from Sickneſs and Diſeaſes may juſtly be looked upon as the beginning of a freſh Period of Life, and (as the throwing off the *Senectus* of theſe Creatures ſeems to be) the renewing of Age (*i*).

Whether one or the other of theſe Reaſons be allowed of, or both thought good, certain it is that ſuch fond and ſuperſtitious Fancies concerning the Viper, together with the miſtaken Opinion that few of its Parts were exempt from Poiſon,

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(*h*) Divinæ Potentiæ Symbolum. Vid. Ezec. Spanhem. De Uſu Numiſmat. p. m. 125, 126, & 181, & ſeq;

(*i*) Saturnal. Lib. 1. c. 20. Ideo Simulachris Eorum (Æſculapii & Salutis) junguntur figuræ Draconum quia præſtant ut humana corpora velut infirmitatis pelle depoſitâ, ad priſtinum revireſcant vigorem, ut vireſcunt Dracones per annos ſingulos pelle ſenectutis exutâ.

ſon, did not ſuffer the Ancients to make any Curious Enquiries into its Nature by Anatomy and Experiments, and this is the Cauſe of the many Errors they have delivered down to us in theſe Points, which by gradual Advance have ſince been rectified, and the inward Make, Properties, and Generation of this Animal, largely treated of; more eſpecially M. *Redi* (*k*), *Charas* (*l*), and Dr. *Tyſon* in his Diſſection of the *Rattle-Snake* (*m*), which is a larger Species of a Viper, have taken Pains on this Subject, to whoſe Diſcoveries, what is yet wanting, we ſhall add at the end of this Eſſay.

The Symptoms which follow upon the Bite of a Viper, when it faſtens either one or both its greater Teeth in any part of the Body, are an acute Pain in the place Wounded, with a Swelling at firſt Red, but afterwards Livid, which by degrees ſpreads farther to the Neighbouring Parts with great Faintneſs, and a Quick, tho' Low, and ſometimes Interrupted Pulſe, great Sickneſs at the Stomach, with Bilious, Convulſive Vomitings, Cold Sweats, and ſometimes Pains about the

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(*k*) Oſſervazioni intorno alle Vipere.
(*l*) Nouvelles Experiences ſur la Vipere.
(*m*) Philoſophical Tranſactions, *Vol. XII. No.* 144.

Navel; and if the Cure be not ſpeedy, Death it ſelf, unleſs the ſtrength of Nature prove ſufficient to overcome theſe Diſorders; and tho' it does, the ſwelling ſtill continues inflamed for ſome time; nay, in ſome Caſes more conſiderably upon the abating of the other Symptoms than at the beginning; and often from the ſmall Wound runs a ſanious Liquor, and little Puſtules are raiſed about it; the colour of the whole Skin is changed Yellow, as if the Patient had the *Jaundice.*

Theſe Miſchiefs, altho' different Climates, Seaſon of the Year more or leſs Hot, the greater or leſſer Rage of the Viper, the Beaſt it ſelf of a larger or ſmaller Size, and conſequently able to communicate more or leſs Venom, and the like Circumſtances, may variouſly heighten or abate 'em, yet do uſually diſcover themſelves much after the ſame manner in all; unleſs the Bite happen not to be accompanied with the effuſion of that *Liquor*, which is the main Inſtrument and Cauſe of this violent and ſhocking Diſturbance.

But before I proceed to enquire into the Nature and Manner of Acting of this *Juice*, it may be worth the while to take Notice, that this is not made on purpoſe to be deadly and deſtructive to *Mankind*;

but that the true deſign of it is (tho' Authors have not regarded it) to perform an Office and Service of ſo great Moment, to the preſervation of the Individual, that without it this Creature could not ſubſiſt.

For Vipers live chiefly upon Lizzards, Frogs, Toads, Mice, Moles, and the like Animals, which they do not chew, but ſwallow down whole, and they lye in the Stomach; or if that be not big enough to receive them, partly in that, and partly in the Oeſophagus, which is membranous, and capable of great Diſtenſion, till by the Salival Juices of thoſe Parts, together with the help of the Fibres of the Stomach, and the contraction of the Muſcles of the Abdomen, they are gradually diſſolved into a Fluid Subſtance, fit for the Nouriſhment of their Bodies, which is the Work of many Days; this is *one* Reaſon why theſe Creatures can live ſo long without taking any freſh Food, which I have known them to do Three or Four Months; as *another* is, that their Blood is a groſſer and more viſcid Fluid than that of moſt other Animals; ſo that there is but a very little expence of it by Tranſpiration, and conſequently leſs need of Recruit; this not only *Microſcopes* diſcover, but Reaſon teaches; becauſe there is but very little Muſcular force in the Stomach to comminute the Food, and make a Chyle of fine Parts, and therefore the Blood muſt accordingly be of a Tough and Clammy Conſiſtence. Now ſuch a manner of Feeding as *this* does neceſſarily Require that the Prey ſhould upon the firſt Catching be immediately Kill'd, otherwiſe it were by no means fit to be let into the Stomach; for we are not to think that the force of this Part would be alone ſufficient to deſtroy it, the ſubtilty of a living Creature (beſides the conſideration of the weakneſs of the Fibres) being in a great Meaſure able to elude *that*, as indeed we do every Day find live Animals in the Ventricles of others; and therefore to do *this* is the proper Uſe both of the Teeth and their Poiſon; for which being deſigned and adapted, it is no wonder if the Viper this ſame way by which it deſtroys its Prey, proves ſometimes Miſchievous to any other Creatures beſides, when it happens to be enraged, or by any Provocation ſtirr'd up to Bite.

The Deſcription of the Poiſonous *Fangs*, their Make, Articulation and Motion, as alſo of the Glands that ſeparate the Yellowiſh Liquor, and the Bags that contain it, I ſhall give, together with ſome Anatomical Obſervations, at the end of this Diſcourſe.

This Venomous Juice it ſelf is of ſo inconſiderable a quantity, that it is no more than one good *Drop* that does the Execution; and for this reaſon Authors have contented themſelves with Trials of the Bite upon ſeveral Animals, never Eſſaying to examine the Texture and Make of the Liquor it ſelf; for which purpoſe I have oftentimes by holding a Viper advantageouſly, and inraging it till it ſtruck out its Teeth, made it to Bite upon ſomewhat ſolid, ſo as to void its Poiſon; which carefully putting upon a Glaſs Plate, I have with a Microſcope as nicely as I could viewed its Parts and Compoſition.

Upon the firſt Sight I could diſcover nothing but a Parcel of ſmall Salts nimbly floating in the Liquor, but in a very ſhort time the Appearance was changed, and theſe ſaline Particles were now ſhot out as it were into *Cryſtals* of an incredible Tenuity and Sharpneſs, with ſomething like Knots here and there, from which they ſeemed to proceed, ſo that the whole Texture did in a manner repreſent a *Spider's Webb*, tho' infinitely Finer, and more Minute; and yet withal ſo rigid were theſe pellucid *Spicula*, or *Darts*, that they remained unaltered upon my Glaſs for ſeveral Months *(n)*.

I have made ſeveral Trials with this *Juice* in order to find out under what Tribe of Salts theſe Cryſtals are to be ranged; and not without ſome difficulty, by reaſon of the Minute quantity of the Liquor, and the hazard of Experiments of this Nature, have plainly ſeen that it does, as an *Acid*, turn the Blue Tincture of *Heliotropium* to a Red Colour.

I did not ſucceed ſo well in mixing it with Syrup of Violets, and yet it did really ſeem to induce in this a *Reddiſh Hue*; but I am very certain it did not at all change it to a *Greeniſh* Colour, as it would have done if any ways *Alcalious*.

This may ſuffice in their own way of arguing to convince thoſe Gentlemen, who without the Aſſiſtance of any Experiments, meerly to ſerve an *Hypotheſis* which they have too fondly taken up, have with great Aſſurance told the World, that the Viperine Venom is an *Alcali*,

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(n) Vid. Fig. 19.

and conſequently to be cured by *Acid* Remedies. But it is by far more eaſie to Spin out a falſe Notion into precarious Reaſonings, than to make faithful Experiments, and fairly improve 'em by juſt and neceſſary Conſequences.

To proceed, this Diſcovery agrees very well with a Relation communicated by an Ingenious Perſon to Dr. *Tyſon*, which does ſo much Illuſtriate this Matter, that I ſhall Tranſcribe it in his own Words out of the before cited *Philoſophical Tranſactions*; he ſays then, that being in the *Indies*, there came to him an *Indian* with ſeveral ſorts of *Serpents*, offering to ſhew him ſome Experiments about the force of their Poiſon; having therefore firſt pulled out a large One, the *Indian* told him this would do no harm; and making a Ligature on his Arm as in letting Blood, he expoſed it naked to the Serpent, being firſt irritated to make him Bite it; the Blood that came out of the Wound made by his Teeth, he gathered with his Finger, and laid it on his Thigh, till he had got near a Spoonful, after this he takes out another called *Cobra de Capelo*, which was leſſer, and inlarges much upon the greatneſs of his Poiſon; to ſhew an Inſtance of it, graſping it out about the Neck, he expreſſes ſome of the Liquor in the Bags of the Gums, about the quantity of half a Grain, and this he puts to the coagulated Blood on his Thigh, which immediately put it into a great *Fermentation*, and working like *Barme*, changed it into a *Yellowiſh* Liquor.

This I ſay does well enough accord with what we have been advancing concerning the Nature of this *Juice*; for Mr. *Boyle* has long ſince proved by Experiments, that there is nothing of Acid in humane Blood; and Dr. *Pitcarn* (o) has demonſtrated, that the *Acid* Subſtances of Vegetables taken into the Stomach, are by the Action of this Part, the Lungs and Heart, when they come into the Blood-Veſſels, turn'd to *Alcalious*; ſo that the Arterial Fluid muſt neceſſarily be conſidered as an *Alcali*; and therefore according to the known Principles of Chymiſtry, its mixture with ſuch a Liquor as we have diſcovered the Viperine *Sanies* to be, will always exhibit ſome ſuch appearance as this now related.

But not to engage any farther in theſe ſort of Controverſies, we may perhaps from the foregoing Obſervations receive ſome Light in order to underſtand the Nature and Reaſon of all thoſe Symptoms which attend the Bite of this Creature. For the pungent Salts of this Venom, when with force thrown into the Wound, will not only as ſo many *Stimuli*, irritate and fret the ſenſile Membranes, whereupon there neceſſarily follows a greater Afflux than ordinary of the Animal Juices that way, (as is manifeſt from the *Bellinian* Doctrine, *De Stimulis*) ſo that the wounded Part muſt be Swelled, Inflamed, Livid, *&c.* but alſo theſe *Spicula* being mixt with the Blood, will ſo disjoin and diſunite the Parts of it, that its Mixture muſt be quite altered; and from the various *Cohæſion* of its *Globules* will ariſe ſuch different Degrees of *Fluidity* and *Impulſe* towards the Parts, *&c.* from what this Liquor had before, that its very Nature will be changed, or in the common way of ſpeaking, it will be truly and really *Fermented.*

(o) Diſſertatio de Opera quam præſtant corpora acida vel Alcalica in curatione Morborum.

To underſtand aright how all this is done, it is Neceſſary to hint ſomewhat concerning the Nature of *Fluids* in General, and thoſe Alterations in them which we call *Fermentations*; for I ſhall retain this known Word, tho' in the proper Sence in which 'tis commonly uſed, there can be no *Fermenting* of the Liquors in the Animal Body.

And here I muſt refer to the Treatiſe of *Bellini de Fermentis*, who has with great clearneſs ſhewn, that there is in all *Fluids* not only a ſimple *Contact* of their Parts, but alſo a *niſus in Contactum*, or *Cohæſion*, and this of a certain *Degree* or *Force*, and beſides, of a particular *Direction*; which is indeed, tho' expreſs'd in other words, the very ſame thing with the *Attraction* of the Particles one to another; This Mr. *Newton* has demonſtrated to be the great Principle of Action in the Univerſe, has taught us the Laws of it in the greater Quantities and Collections of *Matter*; and he who rightly Studies his Philoſophy will underſtand, that the ſame obtains in the moſt Minute and Fineſt Corpuſcles, which do Unite into Bodies of different *Solidity* and *Make*, according to the Degree with which they do mutually *attract* each other, and to the *Superficies*, by which, when drawn, they do *touch* and *adhere*. To this if we add a *Preſſion* of the ſeveral Parts of the Fluid, perpendicular to the ſides of the Veſſel in which it is contained; and conſider withal, that this *Uniform* Attraction of the Parts to one another muſt be variouſly changed by the different Attraction of Heterogeneous Bodies mixt with them, we have the great Principles of all Fluids, upon which their ſeveral *Phænomena* do depend.

And hence it follows, that whatſoever *Power* is ſufficient to make a change in this Attraction, or Cohæſion of the Parts, makes an Alteration of the Nature of the Fluid; that is, as the Chymiſts expreſs it, puts it into a *Fermentation.* And if any one ſhall think it neceſſary to enquire into the particular Manner of producing ſuch an Effect, we may perhaps in ſo abſtruſe a Matter not improbably Conjecture *thus*, That our Blood conſiſting chiefly of Two Parts, a ſimple *Lymph*, and an infinite Number of ſmall *Globules*, containing a very ſubtle and elaſtick Fluid, theſe acute Salts, when mingled with it, do prick thoſe Globules, or *Veſiculæ*, and ſo let out their impriſoned active Subſtance, which expanding it ſelf every way, muſt neceſſarily be the Inſtrument of this ſpeedy Alteration and Change (*p*). From ſuch an *Hypotheſis* as this (and, it may be, not very eaſily from any other) we may account for many of the ſurprizing Phænomena

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(*p*) Vid. Bernoulli de Effervеſcentia & Fermentatione.

in the Fermentations of Liquors; and as precarious as it ſeems, its Simplicity, and Plainneſs, and Agreement with the forementioned Doctrine, will, I believe, recommend it before any other to thoſe who are not unacquainted with *Geometrical* Reaſonings. But I wave theſe Conſiderations at preſent, and ſhall only add One Remark or Two with Relation to the purpoſe in Hand, and ſo proceed.

In the firſt place then, we may, from this *Theory*, learn, how it comes to paſs that ſo ſmall a Portion of Juice ſhould infect ſo great a quantity of Liquor; for in order to do this, it is not neceſſary that the Venom ſhould be at the very firſt mixt with all its Parts; but it is ſufficient that it prick ſome of the *Bladders*, and the elaſtic Matter of theſe being let out, will be a nimble *Vehicle* to the acute Salts, and not only by its activity diſperſe them thro' the Fluid, but reſtore to them their decreaſing *Force*, and thus continue their Effects, till a great Part of the Liquor undergoes at leaſt, in ſome Degree, the like Alteration.

And this will the more eaſily happen in the preſent Caſe, becauſe the *Force* with which this Poiſon is thrown into the Blood (as appears from the Mechaniſm of the diſcharging Organs) is very great, and conſequently its Effects will be proportionably violent, or the Miſchief more large and diffuſed.

The want of *this* may be one Reaſon why the Experiment of firſt making a Wound in the Fleſh with any ſharp Inſtrument, and then dropping in the *Sanies*, may not always ſucceed ſo well in killing Animals, as one would from the preceeding Doctrine be ready to expect. Tho' if ſome amends be made for this Defect, by taking a greater quantity of the Juice, and carefully Inſtilling it, It proves equally Fatal this way, as when immediately diſcharged from the Viper it ſelf. Thus it might happen that thoſe Trials of this kind which were happily made by S^r *Redi*, might not however convince Mr. *Charas*, in as much as there is oftentimes a great deal of difference in the Event of Experiments, when made with Purpoſe, and a Deſign that they ſhould Succeed, and when Timorouſly and Cautiouſly managed, leſt they ſhould unluckily overthrow a darling *Hypotheſis*.

The other Obſervation I ſhall draw from the foregoing Theory is this, That it appears from hence what a vaſt *variety* there may be in the Fermentations even of one and the ſame Fluid; for theſe being no other than *Changes* made in the *Cohæſion* of the compounding Particles, are capable of as many Alterations as *Motion* in its *Degrees* and *Directions* can admit of, which are really Infinite.

This I mention with regard to ſome of the following *Eſſays*, in which if we aſcribe many Symptoms ſeemingly very different, to a Ferment raiſed in the Blood, it may be conſidered that the Nature of this Cauſe is ſuch, as according to the ſeveral Properties of the *Primum Agens*, or *Fermenting Power*, to bear by far more Varieties than any one can be aware of.

To return to the Viper; the Effects of ſuch an agitation of the Blood as we have been deſcribing, muſt not only be whatever are the Conſequences of a diſturbed *Circulation*, and irregular and interrupted *Secretion* of the Spirits, as low Pulſe, Faintings, Sickneſs, Palpitation of the Heart, Convulſive Vomitings, Tremblings of the Body, *&c.* but alſo the *Texture* of this Fluid being thus broken, thoſe Parts of it which are of ſloweſt Motion, and greateſt Viſcidity, will be eaſily ſeparated from the others; ſuch they are, which when united together do compound the *Bile*, and therefore theſe will

Tinge the capillary Veſſels, and fine *Ducts* in the Skin, with a Yellowiſh Colour; that is, will induce an *Icterus*, or Jaundice.

For it is not only (if at all *Primarily*) from an Obſtruction of the *Biliary Canals* that this Symptom does proceed, but alſo from any Cauſe whatſoever which either deſtroys the Saline Part of the Bile, by the means of which its Oil is kept Mixt with the Water of the Blood, or elſe increaſes the Oily and Sulphureous Part to that Degree, that tho' it be duly impregnated with Salt, yet the Watery Part of the Blood, which can only take up a certain Proportion of it, being already *Saturated*, can receive no more; or laſtly, does by *diſuniting* the compounding Particles of the Blood, alter that *Inteſtine* Motion and Agitation which is neceſſary to carry along thro' the Veſſels, together with the more Volatile Parts, thoſe which are more Clammy and Glutinous. For in all theſe Caſes 'tis plain that the Bilious Corpuſcles muſt be *præcipitated* upon thoſe Parts of the Body where there is leaſt Motion, that is, upon the extream Superficies.

And tho' this Theory may perhaps appear Extravagant, becauſe new and uncommon, yet it will not, I believe, ſeem ill grounded or irrational to thoſe who underſtand the Doctrine of the *Mixture* of Heterogene Fluids, and their *Separation*; and who withal know, that the Veſſels are rarely obſtructed, unleſs it be from the fault of the Liquid they carry, and conſequently that a defect in the Bile it ſelf muſt be (excepting ſome extraordinary Caſes) antecedent to the Obſtruction of the Biliary Ducts.

In ſhort, the different Cure of this Diſeaſe confirms theſe Notions; for an *Icterus* from the firſt Cauſe aſſigned, which is generally owing to a Sedentary Life, want of Exerciſe, *&c.* and attended with an extream Coſtiveneſs and white *Fæces*, is cured by Volatile, Acrimonious and Bitter Salts. From the Second, produced oftentimes by Drinking ſtrong Liquors, Spirits, *&c.* and accompanied with a Diarrhæa, partly by Diluting and Temperating, partly by Stomachick and Strengthning Medicines. As the laſt Species of it (for the ſake of which we have mentioned the other) is removed by ſuch *Antidotes* as overcome and deſtroy the Venomous Ferment, corrupting the Blood, and breaking its *Compages*. But to have hinted theſe things may abundantly ſuffice for the preſent.

We muſt however take Notice, that *tho'* the *main* Alterations made by this Poiſon be in the Fluid of the Arteries, *yet* that *That* of the Nerves may hereby be conſiderably *changed* too; for *This* conſiſting, as well as the Blood of differing Parts, and being diſperſed in ſmall *Tubes* all over the Body, is not only very capable of *various* Degrees of *Force*, *Impulſe*, *&c.* but *Undulating* continually towards the Brain, and being the chief Inſtrument of Motion and Action, may perhaps ſometimes more immediately convey the Miſchief to the ſenſile Membranes, and thus be the cauſe of thoſe violent Pains, Convulſions, Sickneſs, *&c.* with which Thoſe who are Bitten are preſently ſeized.

Many are the Experiments I could relate to evince the Truth of this Reaſoning concerning the Viperine Venom, which do entirely agree with thoſe made by S^r^ *Redi*, whoſe Judgment and Sincerity in Obſervations of this Nature no Body ever called in Queſtion, till Monſieur *Charas* having eſpous'd a Notion, that this Poiſon does not lye in the Yellow Liquor of the Gums, but in the enraged Spirits of the Viper, rais'd new Difficulties about the Succeſs of ſome Trials made in *France*, endeavouring thereby to invalidate the Force and Authority of thoſe made in *Italy*.

I ſhall therefore, in order to put this Matter out of all doubt, mention Two or Three Experiments made by Dr. *Areskine*, when at *Paris*, that it may appear how defective thoſe of Mr. *Charas* are, and that the difference of the Climate does not (as ſome began to imagine (*a*)) make any conſiderable alteration in the Effects of this Venom, or its manner of Killing.

Firſt then, having got a large Female Viper, he made it to Bite Six Pigeons, one after another; the Firſt and Second that were bit Died within about half an Hour, one a little Time before the other; the Third lived about Two Hours; the Fourth ſeemed to be very Sick, but recovered; the Fifth and Sixth were no more hurt than if they had bin prick'd with a Pin or Needle.

Then he cut off the Head of a brisk Viper, and let it lye Twenty-four Hours, with the Fangs of which he wounded One Pigeon in the Breaſt, and another in the Thigh, which both expired as ſoon after,

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(*a*) Vid. Redi Lettera ſopra alcune oppoſitioni, &c.

as if they had bin bitten by a living Viper. After this, having got a great many Vipers together, he made them Bite upon a peice of Glaſs of a Cylindrical Figure, by this means preſerving the Yellow Juice which they emitted, and ſlightly wounding Two Pigeons, he firſt let the Bleeding be ſtopt, then put ſome of this Liquor into the Wounds, upon which both the Pigeons Died about Two Hours after.

The ſame Ingenious Perſon tells me, that Monſieur *du Verney* made not only Theſe, but alſo ſeveral other Experiments of the ſame Nature, in the *Royal Academy*, with the like Succeſs.

Theſe Proofs are ſo convincing and full, that no one, I think, can deſire more; but they will receive yet a farther Confirmation from the *Apparatus* or Mechaniſm of the Organs, with admirable Nicety contrived for the diſcharge of this Venom, of which more by and by.

Nor is it any Objection againſt all *This*, that the *Liquor* is innocent and harmleſs in the Mouth or Stomach of any one, ſo as that it may be ſafely taſted or ſucked out of the Wound and ſwallowed; for *as* we obſerved before, that many *Acid* Subſtances taken into the Stomach are by the Action of that Part turned to *Alcali-*

ous, ſo there is no Queſtion but theſe Saline *Spicula* are partly by the Muſcular Force of the Fibres, partly by the Salival Juice, all broken and diſſolved; or if any can paſs into the Inteſtines, the Balſam of the *Bile* will be an *Antidote* for Them; the Reaſon of which will appear when we come to the Cure.

In the mean time it may not be amiſs to Remark, that even the Ancients ſeem to have known thus much concerning the Nature of this Poiſon; of this *Gallen* gives us Teſtimony in ſeveral Places; particularly in his Book *de Temperamentis* (*b*), where he takes notice, that *nothing has the ſame Power upon the human Body outwardly as inwardly*; *Thus* (ſays he) *neither the Venom of the Viper, nor of the Aſp, nor frothy Spittle of the Mad Dog, are alike Miſchievous when they fall upon the Skin, or enter into the Stomach, as when outwardly communicated by a Wound.*

The chief of the Latin Phyſicians (*c*), *Celſus* has elegantly expreſs'd the Matter in few Words, when adviſing to *Suck* the Wound made by the Bite; he adds, *Neque Hercules Scientiam præcipuam habent hi*

(*b*) Lib. 3. c. 3.
(*c*) Medicin. *l.* 5. *c.* 27.

qui Pſilli nominantur, ſed audaciam uſu ipſo confirmatam, nam Venenum Serpentis, ut quædam etiam Venatoria Venena, quibus Galli præcipue utuntur, non guſtu ſed in Vulnere nocent.

And therefore brave *Cato*, when marching the Remains of *Pompey*'s Army thro' *Africa*, very wiſely told the Soldiers almoſt Choak'd with Thirſt, yet afraid to drink of a Spring they came to, becauſe full of Serpents (*d*).

Noxia Serpentum eſt admiſto Sanguine Peſtis,
Morſu Virus habent & Fatum Dente minantur,
Pocula Morte carent——

In the like manner it was in thoſe times alſo known, that the Virulent Juice had the ſame bad Effects, when mixt with the Blood, by means of a common Wound, as when communicated by the Venomous Bite. This made *Celſus* (*e*) adviſe in ſucking out the Poiſon, to take care there be no Ulcer in the Mouth; tho' this Caution be rather ſlighted and ridiculed by *Severinus* (*f*), and others;

(*d*) Lucan. Pharſal. *l. 9.*
(*e*) Loc. ante citat.
(*f*) Vipera Pythia, *p.* 361.

who do hereby diſcover how little they underſtood of the Seat and Nature of this Poiſon. And *Galen (g)* mentioning the Story of *Cleopatra*, relates from other Authors, that ſhe killed her ſelf *by pouring the* Virus *of an Aſp into a Wound made in her Arm by her own Teeth.*

In ſhort, it is upon this Foundation, that *Pliny (h)* aſſures us, the *Scythians* Poiſon'd their Arrows with the *Sanies* of Vipers mixt with human Blood; the way of doing it *Ariſtotle (i)* has at large related; and the *Tartars* are ſaid to uſe the like Trick to this Day. After the ſame manner the *Indians* make uſe of the Venom of the Lizard, called *Gecco*; this Creature they hang up by the Tail, and by Whipping exaſperate till it diſcharge its *Virus*, in which they Tinge their Darts; and a very ſlight Wound with theſe Weapons is ſpeedy Death *(k)*.

It is worth the while in the next Place to conſider the Cure of this Miſchief, which without all doubt ought to be by ſuch External Management of the Wound

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(g) De Theriac. ad Piſon. *lib.* 1. *c.* 8. Vid. etiam *c.* 10.

(h) Nat. Hiſt. *lib.* 11. *c.* 53. Scythæ Sagittas tingunt Viperinâ Sanie & humano Sanguine; irremediabile id Scelus.

(i) De Mirabilibus.

(k) Bontii Hiſtor. Ind. *lib.* 5. *c.* 5.

as may immediately deſtroy the infuſed Venom.

Mr. *Boyle* (*l*) experienced a hot Iron held as near the Place as the Patient could poſſibly endure it very effectual to this Purpoſe. But the ſame Method did not anſwer Expectation in the Famous Caſe related by Monſieur *Charas* (*m*).

An extraordinary Virtue againſt this and other venomous Bites is aſcribed to the *Snake-ſtones* brought from the *Eaſt-Indies*, one of which is to be preſently apply'd to the Part, and let ſtick till it drop off; theſe are ſaid to be taken out of the Head of the Serpent called by the *Portugueze*, *Cobra de Capelo*; and to ſuck the Poiſon out of the Wound. S^r^ *Redi* (*n*) made Trials with ſeveral of them, but found no Service from any. Yet *Baglivi* (*o*) tells us of a terrible Bite of a Scorpion cured this way. Monſieur *Charas* (*p*) his Pigeons all died, tho' *theſe* were immediately clapped on, and ſtuck cloſe to the Wound: But Dr. *Havers* ſaw a good Effect of *one* upon a Dog,

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(*l*) *Uſefulneſs of Experimental Philoſophy*, Part 2. Page 50.
(*m*) p. m. 66.
(*n*) Eſperienze intorno a diverſe Coſe Naturali.
(*o*) Diſſert. de Tarantula Hiſtor. 5.
(*p*) Pag. 88.

who tho' ſeverely Bitten, ſuffered no Harm, nor any farther Mark of the Poiſon than a livid Circle round the Place.

In plain Truth, *as* theſe celebrated *Stones* do not ſeem to be what it is pretended they are, but rather Factitious Bodies compounded, it may be, of Calcined Bones, and ſome Teſtaceous Matters mixt together; *ſo* by Reaſon of their ſpongy and porous Texture, they do very readily adhere to any moiſtened Part of the Fleſh, and imbibe whatſoever humidity they meet with. This their quality any one may Experience by holding one of them to the Roof of his Mouth; and it is upon this Score, that when put into Water, Bubbles are raiſed by the Air in their Interſtices, which ſome have too fondly thought to be the Effects of their throwing out the Venom they had ſucked in.

Their *make* being thus, ſome Part at leaſt of the Poiſonous Juice may eaſily be drawn out of the Wound by ſuch an Application, and yet ſo much of *it* may ſometimes happen to remain in the Fleſh as may make the Bite however to prove Mortal. And thus it fared with a Pigeon, to the Thigh of which, firſt Bitten by a Viper, I applied one of the Stones; for tho' it ſtuck faſt to the Wound, and thus ſaved the Life for about Four Hours; (whereas others uſually died in about half an Hour) yet after this the Mortification of the Part prevailed to that Degree as to become fatal to the tender Creature.

But our *Viper-Catchers* have a Remedy far beyond all theſe, in which They do place ſo great Confidence, as to be no more afraid of a Bite than of a common Puncture, immediately curing themſelves by the Application of their *Specifick*.

This, tho' they keep as a great Secret, I have however upon ſtrict Enquiry found out to be no other than the *Axungia Viperina* preſently rubbed into the Wound. And to convince my ſelf of its good Effects, I inraged a Viper to Bite a young Dog in the Noſe; both the Teeth were ſtruck deep in; he howled bitterly, and the Part began to ſwell; I diligently applied ſome of the *Axungia* I had ready at Hand, and he was very well the next Day.

But becauſe ſome Gentlemen who ſaw this Experiment were apt to impute the Cure rather to the Dog's Spittle, (he licking the Wound) than to the Virtue of the *Fat*, we made him to be bit again in the Tongue, forbearing the uſe of our

Remedy, and he Died within Four or Five Hours.

At another time I made the like Trial with the ſame Succeſs.

As this *Axungia* conſiſts of Clammy and Viſcid Parts, which are withal more Penetrating and Active than moſt other Oily Subſtances, *ſo* theſe, without all Doubt, do Involve, and as it were Sheath the Volatile Salts of the Venomous Liquor, and thus prevent their Shooting out into thoſe Cryſtalline *Spicula*, which we have obſerved to be the main Inſtruments of that deadly Miſchief which attends the Bite.

By this means it comes to paſs, that this Cure, if rightly managed,is ſo eaſie and certain, as not to need the help of any *Internal* Medicines to forward it; but *Theſe* however muſt take place, where thro' want of the other, the Poiſon i ſpread farther, and has tainted the whol Maſs of Blood.

Nor yet is it neceſſary even in this Caſ to Fatigue the Patient with a *Farrago* o *Theriacas*, *Antidotes*, &c. for the *Volatil* *Salt* of Vipers is alone ſufficient to do the Work, if given in juſt Quantities, and duly repeated ; provided Moderat Sweats be Incouraged in Bed ; thus i

ſucceede

ſucceeded with Monſieur *Charas* in the before cited Caſe, and in ſome others I could relate, in one of which the Miſchief had gone ſo far as to induce an univerſal *Icterus.*

This leads me laſt of all to hint ſomething concerning the Uſe of the Viper in *Phyſick*; becauſe Authors are very large in enumerating its Virtues againſt many, and thoſe too ſome of 'em very obſtinate, Diſtempers.

One of the firſt whom we find in Antiquity to have made uſe of the Fleſh of this Creature to Medicinal Purpoſes, was, I think, *Antonius Muſa*, the Famous Phyſician to *Octavius Cæſar*; of whom *Pliny* (*q*) tells us, That *when he met with incurable Ulcers, he ordered the eating of Vipers, and by this means they were quickly Healed.*

It is not improbable that he might have learned this from the Great Greek Phyſician *Craterus*, mentioned often by *Cicero* in his Epiſtles to *Atticus*, who, as *Porphyrius* (*r*) relates, *very happily cured a miſerable Slave, whoſe Skin in a ſtrange manner fell off from his Bones, by adviſing him to*

(*q*) Lib. 30. c. 13.
(*r*) De Abſtinent. ab animal. *lib.* 1. *p. m.* 16.

feed upon Vipers dreſſed after the manner of Fiſh.

Be this as it will, in *Galen*'s time the profitable Qualities of the Viper were very commonly known; himſelf relating (*s*) very Remarkable Stories of the Cures of the *Elephantiaſis*, or *Lepra*, done by the Viper Wine.

Aretæus, who moſt probably liv'd about the ſame time with *Galen*, and of all the Ancients has moſt accurately deſcribed the *Elephantiaſis*, commends, as *Craterus* did, the eating of Vipers inſtead of Fiſh in the ſame Diſeaſes (*t*). And to this purpoſe I remember, that *as Lopes* (*u*) in his Relations of the Kingdom of *Congo* in *Africa*, takes notice how greedily the *Negroes* eat *Adders*, roaſting them, and eſteeming them as the moſt delicious Food; *ſo Dampier* (*x*) alſo informs us, that the Natives of *Tonquin* in the *Eaſt-Indies* do treat their Friends with *Arack*, in which *Snakes* and *Scorpions* have been infuſed, accounting this not only a great Cordial, but alſo an Antidote againſt the *Leproſie*, and all other ſorts of Poiſon.

(*s*) De ſimpl. Medic. Facult. *lib.* 11. *c.* 1.
(*t*) Curat. Diuturn. *lib.* 2. *c.* 13.
(*u*) Vid. Purchas. *Pilgrims*, Part 2. l. 7. c. 9.
(*x*) *Voyages*, Vol. 2. Part 1. p. 53.

The Phyſicians in *Italy* and *France* do very commonly Preſcribe the Broth and Gelly of Vipers Fleſh for much the ſame Uſes, that is, to invigorate and purifie the Maſs of Blood exhauſted with Diſeaſes, or tainted with ſome Vicious and Obſtinate *Ferment.*

From all this it appears, that the main Efficacy of the Viperine Fleſh is to quicken the Circle of the Blood, promote its due Mixture, and by this means cleanſe and ſcoure the *Glands* of thoſe Stagnating Juices, which, turning to Acidity, are the Origine of many, at leaſt, of thoſe troubleſome Diſtempers in the Surface of the Body which go under the Names of *Scrophulous*, *Leprous*, &c.

Theſe good Effects are owing to that penetrating, ſtrong *Salt*, with which the Subſtance of theſe Creatures does in a very great Proportion abound; and the Reaſon of *this* is from the Food they live on, which we have obſerved before to be Lizzards, Moles, *&c.* whoſe Nature every one knows to be ſuch as muſt neceſſarily, when they are diſſolved in the Stomach, ſupply the Blood with a great Quantity of Active and Volatile Parts. And herein lyes the difference between the Fleſh of Vipers, and *that* of other Innocent Serpents, which feeding upon Graſs, Herbs, *&c.* do not recommend themſelves to us by any of thoſe Properties which are in ſo Eminent a Degree found in the former.

Whoſoever Reflects on what has bin ſaid on this Head, will very readily Acknowledge that our Phyſicians deal too Cautiouſly or Sparingly with a Remedy which may be applied to very good Purpoſes, when they Preſcribe a few Grains of the *Pouder* of dried Vipers, or make up a ſmall Quantity of their Fleſh into *Troches*; whereas if Service be really to be done this way, the Patient ought to eat frequently of Viper Gelly, or Broth; or rather, as the ancient manner was, to Boil Vipers, and eat them like Fiſh; if this Food will not go down, (tho' really very Good and Delicious Fare) to make uſe at leaſt of Wine, in which Vipers have for a long time been infuſed, by which I know a very obſtinate *Lepra* has bin removed; or laſtly, in ſome Caſes, eſpecially where Wine is not Convenient, to take good Quantities of their *Volatile Salt*, in which alone the Virtue of the before named Medicines does Principally reſide.

AN
APPENDIX
TO THE
Foregoing Eſſay;

Containing ſome Anatomical Obſervations on the Viper, *and an Account of ſome other* Venomous Animals.

IN repeated Diſſections of the *Viper*, comparing the *Deſcriptions* given Us by Authors with the *Parts* themſelves, I have found them in many Particulars to be very Defective. I ſhall however at preſent confine my ſelf to ſome Obſervations made chiefly on thoſe Organs which ſerve to Prepare and Emit the *Poiſon*.

To begin therefore with the Head. The *Skull* (*Fig.* 2.) is compoſed of ſeveral Bones, joined together by *Sutures*, as in *Man*, but with this Difference, that The *Os Frontis* in the Viper conſiſts of Two Bones united by a Rectilinear *Suture*, and the *Parietal* Bones are Entire; whereas in Man the *Parietal* Bones have *Sutures*, and the *Os Frontis* is Entire.

(*a*) Shows Two ſmall Semicircular Bones, which form the inferior Part of the *Noſtrils*.

(*b*) The Two Bones which make the upper Part of the *Noſe*, from the latter paſs down two thin *Laminæ*, which touching one another, and falling perpendicular upon the *Oſſa Palati*, compoſe the *Septum* of the Noſe.

(*e e*) Point out the *Oſſa Frontis*, which form the upper Part of the *Orbits* of the Eyes. And (*c c*) the *Orbits* themſelves.

The *Parietal Bones* (*d*) make a large Cavity, in which the greateſt Part of the Brain is contained, and *This* we may call the *Sinciput*.

Behind This Bone are placed the *Oſſa Temporum* (*f f*), in which lye the Organs of *Hearing*; and behind Them a Bone (*g*) which we may call the *Os Occipitis*,

pitis, covers the poſterior Part of the Brain. This is joined to the firſt *Vertebra* of the Neck (*b*) by a Spherical Articulation, as all the *Vertebræ* are to one another, and this is the Reaſon why this Creature can turn Its Head and Body ſo much, and ſo nimbly, every way.

To ſome of *Theſe* there are Two other Bones Articulated for Particular Uſes.

The Firſt of *Them*, which ſerves as a *Baſis* to the Articulation of the Reſt (*a Fig.* 4.), is faſtned by one Extremity to a ſmall Protuberance (*i Fig.* 2.) in the middle and lateral Part of the *Os Sincipitis*, and running back towards the *Vertebræ*, lyes in the ſame Plain with the *Sinciput*. This Bone has a Motion, tho' very Inconſiderable, both upwards and downwards. By means of This, the opening of the Mouth is ſomewhat inlarged in the time of *Deglutition*.

That end of This Bone, which is next to the *Vertebræ*, is Articulated at Oblique Angles with *Another* (*b*), placed Horizontally, and whoſe Motion is forwards and backwards, being made chiefly for moving the Bones of the upper and lower Jaw, into which the Teeth are inſerted. By reaſon of this kind of Articulation, It cannot contribute any thing towards Widening the Mouth for Swallowing.

This Bone, and That with which it is joined, I call the *Common Bones.*

The *Upper Jaw* (*Fig.* 3.) is, beſides the Teeth, compoſed on each ſide of *three* Bones. The *Firſt* (*a*), into which the Poiſonous *Fangs* are fixt, is articulated with the Anterior Protuberance of the *Orbit* of the Eye; and has a Motion of Flexion and Extenſion, that is, forwards and backwards, by which the *Fangs* are Erected or Depreſs'd. It is ſmall at the Joint, but grows broader by degrees, to a pretty large *Baſis*, the better to contain a conſiderable Number of *Teeth.* It is *Spongy* like the ſubſtance of of the *Vertebræ*, and no ways fit to be the immediate Organ of *Hearing*, as Mr. *Charas* and ſome others have Imagined.

The *Second* (*c*), is a broad thin Bone, Articulated by *one* extreme to the *Former*, (*f*) and by the *other* firmly fixt to the Middle of the *Third* Bone. When *This* is thruſt forwards, it likewiſe Puſhes the *Firſt*, and by this means the *Erection* of the Fangs is helped; and when It is pull'd backwards, They are *Depreſſed.*

The *Third* Bone (*e d*), is join'd by one extremity (*e*), to the end of one of the Bones of the Lower Jaw (*c Fig.* 4.), And being ſomewhat crooked, turns in a little towards the *Baſis* of the *Cranium*, and running along the Inferior part of It towards the *Noſe*, terminates near the Internal and Anterior part of the *Firſt* Bone.

The *Lower Jaw* (*c d e f g Fig.* 4.) on each ſide is made up of two Bones, but firmly united, the extremity of the *one* entring within the *other* (*f*). The Firſt (*c d e*) articulates with the *Second* of the *Common Bones* (*b*), where it is broad, and ſends off an *Apophyſis*, into which there is a *Muſcle* inſerted, which helps to open the *Jaw*. There is in *This* a *Hole* (*d*), for the Entrance of the Branch of the *Nerve*, which paſſing thro' a *Canal* in the middle of It, goes to the extremity of the *Second* Bone, and in its way ſends off ſeveral Branches which go to the *Teeth*; and alſo a very conſiderable one, which goes out at (*e*), and is wholly ſpent upon the Neighbouring *Muſcles*.

The *Second* Bone (*f g*), ſerves chiefly to receive the ſmall *Teeth*, which anſwer to *Thoſe* in the Upper Jaw.

As for the *Teeth*, they are of two ſorts, the *Great* or Poiſonous Fangs, and the *Small*.

The *Great* (*b Fig.* 3.), being fixt in the Firſt Bone of the *Upper Jaw*, are Crooked and Bent, like the *Dentes Canini* in moſt *Carnivorous* Animals. They are manifeſtly hollow from their Root a conſiderable way, not to the very *Apex* or Point, (which is ſolid and ſharp, the better to pierce the Skin) but to a ſmall diſtance from It, as is plainly ſeen by ſplitting the Tooth thro' the middle (*Vid. Fig.* 6.). This Cavity ends at the Convex Part in a viſible *Slit*, very well reſembling the *Nip* or *Cut* of a *Pen* (*Fig.* 9. *d*), which is the *Emiſſary* or Outlet to the Poyſon.

Galen (*a*) has given Us a conſiderable Hint of This Make of the Tooth: For, *The Mountebanks* (He ſays) *uſed to ſuffer themſelves to be Bit by Vipers, having firſt with ſome Paſtes ſtopt the Holes of their Teeth, that the Venom being thus kept in, the Spectators might think They did by their Antidotes ſecure themſelves from its dangerous Effects.*

The Reaſon why theſe Teeth are

(*a*) De Theriac. ad Piſon. *Cap.* 12.

Crooked is, That the *Point* of the Tooth, when the Viper Bites, may be *Perpendicular* to the Part to be Wounded; for the Head being raiſed back in the time of Biting, and the Tooth erected, if *This* were ſtrait, It would not by reaſon of its oblique Situation to the Part enter with ſo much force, nor ſo deep into the Fleſh.

As for the *Number* of the Poiſonous Fangs, I have obſerved, that there are, for the moſt part, beſides One, Two or Three on each ſide, fixt Perpendicularly to the firſt Bone of the Upper Jaw, ſome others which are Young, and of a ſmaller Size, adhering to the ſame Bone: Their *Points* are hardened, and they have their *Fiſſures* formed as in the other, but their *Roots* are Soft and Mucilaginous, like the Roots of the Teeth in Infants, and ſo they lye always depreſs'd at the *Bottoms* of the *Former*, as may be ſeen *Fig.* 10. *c.*

They drop off from the Bone at the leaſt Touch; and therefore ſome Anatomiſts have imagined them to be faſtened to Muſcles or Tendons, which would have rendred Them altogether Uſeleſs. For they are made to ſupply the place of the *Greater*, when they fall away, or are pulled out by Accident; and in order to this, they do by degrees harden, and riſe more and more, till at laſt they ſtand upright, and come to a Perpendicular Situation in the Bone.

They are not all of the ſame *Growth*, for in ſome we can only diſcern the ſhape of a Tooth without any hardneſs, in *others* the Point, and in the *next* ſomewhat more is hardened, and ſo on to the greateſt Fang.

Their Number is very uncertain, there being ſometimes Six or Seven in each ſide of the Jaw, ſometimes fewer.

Theſe ſeem to have occaſioned the Diſputes among the Ancients concerning the Number of the Viperine Teeth.

The Poyſonous Fangs have ſmall Holes at the Internal Part of their Root, thro' which the Veſſels paſs which carry their Nouriſhment (*Fig.* 5. *a*).

It is remarkable, that Nature has provided Young Vipers with Poiſonous Teeth grown to their Perfection, that ſo they may Kill their Prey as ſoon as they come into the World.

The *Second* kind of Teeth, or the *Small*, are hooked, and bent as well as the former, but without any *Slit* or Opening. Of Theſe there are Four Rows

Two on each ſide of the Mouth. They are fixt in the *Third* Bone of the Upper Jaw, and in the *Second* in the Lower, as exhibited to view in the *Figures.*

Their *Uſe* is to hold the Prey faſt while Execution is done by the Bite, leaſt in ſtruggling to get away It ſhould pull out the Fangs.

The Inſtruments that *Emit* the Venom being thus deſcribed, we come next to *Thoſe* which ſerve to *Prepare* and *Contain* It.

This *Liquor* is ſeparated from the Blood by a *Gland* on each ſide of the Head, placed in the Anterior and Lateral Part of the *Os Sincipitis*, juſt behind the Orbit of the Eye (*Fig.* 9. *a*); It lyes immediately under that Muſcle which helps to depreſs the Fangs, ſo that by the Action of *This* it is Preſs'd; which is an admirable Contrivance to forward the *Secretion* of the Juice out of It.

'Tis a *Conglomerated* Gland, compoſed of many ſmaller ones contained in a common Membrane; each of Theſe ſends off an Excretory Veſſel, all which do afterwards Unite and Form one *Duct* (*b*), which running towards the Roots of the Fangs, diſcharges the Yellow Liquor into a *Bag*, This *Bag* is fixt to the *Baſis* of the *Firſt* Bone of the Upper Jaw, and alſo to the extremity of the *Second*, covering the Fangs near the Root (*d Fig.* 10.). To the upper Part of this *Veſicula* there is joined *another* (*a*), in the Anterior Part of which there is a Paſſage for the Poiſonous Teeth.

This conſiſts of Muſcular Fibres, both *Longitudinal* and *Circular*, by Means of which it can *Contract* it ſelf when the Fangs are erected; and by this Contraction the *Venom* is preſs'd into the Hole at the Root of the Tooth, and forced out at the Fiſſure near the Point.

That this is ſo done, I have frequently obſerved with the Naked Eye, having cut off the Head of a Viper, and immediately pinching the Neck to make it open the Mouth wide; for by this means the Venom was *Squirted* out as from a *Syringe.*

When the Viper lyes quiet with Its Mouth ſhut, the Fangs are depreſs'd and covered with the *External Bag*; when It intends to Bite, It opens the Mouth very wide, at the ſame time the Lower Extremity of the *Second* of the *Common* Bones (*Fig.* 4. *b*) is moved forwards by Proper Muſcles, and turns as it were upon the fixt

Centre (*b*), thus puſhing forward the Upper and Lower Jaws, whoſe Extremes are united at (*c*). By this means the Lower Part of the Firſt Bone of the Upper Jaw (*Fig.* 3. *a*) is thruſt forwards, the other Extremity turning in the Cavity of its Articulation, where it is faſtened by *Ligaments*; the Fangs being by this Mechaiſm Erected, the Bags which cover'd hem, by the Contraction of their *Longiudinal* Fibres, are pulled back, and the Action of the *Circular Ones* does at the ame time ſtraiten the *Internal* Bag, and orce the *Juice* into the Teeth.

Beſides this, when the Viper bites, It trikes in the Fangs to the very Root; and hus the *Veſiculæ* are ſtill more ſqueezed or the diſcharge of the Liquor.

It is worthy our Obſervation, that the Viper can move the Jaw Bones on *one* de without moving Thoſe on the *other*, or they are not joined together at the xtremes as in other Animals; which ontrivance is very Beneficial to It in the *wallowing* Its Prey, in that while the Teeth on one ſide ſtand unmoved, and xt in the Fleſh to hold It, *Thoſe* on the ther ſide are brought forward, to draw t in farther, then they keep It faſt till the ormer Jaws advance again in their *Turn.*

Thus They act ſucceſſively, and force the Animal intire (There being no *Dentes Inciſivi* or *Molares* to divide It) into the *Oeſophagus*, whoſe Muſcular Fibres are very Weak, and can help but little in the Buſineſs.

It may not be amiſs to conclude Theſe *Remarks* with a ſhort *Hint* concerning the *Organs of Hearing*; Mr. *Charas* (who is however followed by others in *It*) having, as we mentioned before, Entertain'd a very abſurd Opinion about *Them*.

Theſe then are Placed in the *Tempora* Bones, as in other Animals, and conſiſt of *One* Long, Small, *Bone* (*Vid. Fig.* 11.), like *That* of *Birds*, whoſe Extremity is Broad, like the *Baſis* of the *Stapes* in *Man*, and ſituated upon a little *Hol* which opens into the *Labyrinth*; and beſides of *Three Demicircular Canals* (*Fig* 12. *a b*) which alſo open into the *Labyrinth*.

This *Labyrinth* (*Fig.* 13.) has a grea many *Eminencies* in It of no determin'd Regular Figure (*Fig.* 14.), and is covered with a *Membrane* full of *Nerves* and *Blood Veſſels*. The *Nerve* enters from th Brain at a hole in the Middle of this *Cavity* (*a Fig.* 15.).

Ther

There is no *Cochlea* in the Ear of the Viper; but the Anterior *Demicircular Canal* opens into a *Semicanal*, which makes ſome *Spiral Turns* in the Fore-part of the *Labyrinth*; in like manner as it is in *Fiſh*.

The *Paſſage* for the Air to theſe Organs is not *Outward*, but, as in ſome Fiſh, thro' the Mouth, between the Upper and Under Jaws, running below the *Second* of the *Common Bones*. But of *This*, and alſo of the True Mechanic *Uſe* of the aforeſaid *Parts*, more hereafter.

Poiſonous Animals.

AS the *Viper* is Hurtful by Inſtilling a Liquid *Poiſon* into the Wound made by Its Teeth, ſo likewiſe are All *Venomous* Creatures whatſoever, whether They *Bite* or *Sting*, tho' there be ſome difference in the Contrivance of their *Organs*, Miſchievous after much the ſame *Manner*; and moſtly for the ſame good *Uſe* and Purpoſe, that is, in order to Kill their *Prey*.

This will fully appear by Examining the *Inſtruments* of Death in ſeveral of *Them.*

Firſt then, The *Spider*, which lives upon Flies, Waſps, and the like *Inſects*, is provided with a hooked *Forceps*, placed juſt by the Mouth, very ſharp and fine; with *This* He pierces the Fleſh of little Creatures caught in his *Webb*, and at the ſame time Infuſes a *Juice* into the Puncture, by which means the Animal being Killed, He Sucks out the Moiſture from the Body, and leaves It a dry, husky Carcaſs.

Mr. *Van Leewenhoek* in his Account of *Spiders* lately publiſhed (*a*), has together with the other Parts, by the help of his Glaſſes, deſcribed theſe *Weapons*, which He finds to lye couched on each ſide the Mouth in a Row of Teeth, till they are raiſed to do Execution. Theſe Rows of Small *Teeth* are deſigned to hold the Prey, that It may not eſcape the Force of the Bite. And in the Convex Part, towards the Point of each *Claw*, He has delineated a little Aperture or *Slit*, thro' which he ſuppoſes the Poiſon Iſſues out at the ſame time the Wound is made.

(*a*) Philoſoph. Tranſact. №. 271.

This *Situation* and *Motion* of Theſe Parts I have ſeveral times viewed; but was never able to diſcern the *Exit* or Opening; which having a juſt deference to the Induſtry and Application of ſo Nice an Obſerver in Things of this Nature, I at firſt imputed to my own Unskilfulneſs in ſuch Enquiries, knowing my *Microſcope* to be very good; till at laſt, after repeated Trials, I very plainly ſaw That nothing Dropt out at the *Claws*, which were always Dry while the Spider Bit, but that a ſhort, white *Proboſcis* was at the ſame time thruſt out of the Mouth, which inſtilled a *Liquor* into the Wound.

Then I concluded that Mr. *Leewenhoek* had Delineated the *Apertures* in theſe *Weapons*, only from the *Analogy* which he thought They muſt bear to the Viperine *Fangs*, The *Sting* of the *Scorpion*, *Bee*, &c. And I was confirmed in this Opinion by examining a *Claw* of the great *American* Spider, deſcribed (tho' but lamely) by *Piſo* (*b*), and called *Nhamdu*; this was given Me by Mr. *Pettiver*, and being above Fifty times bigger than *That* of the largeſt *Europæan* Spider (*c*), if there had

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(*b*) Nat. Hiſt. *lib.* 5. *cap.* 10.
(*c*) Vid. *Fig.* 18.

bin any Slit in It, my Glaſs would no doubt have diſcovered It, but yet I found it to be quite Solid.

And indeed the quantity of *Liquor* emitted by our common Spiders when they Kill their Prey, is viſibly ſo Great, and the wounding *Weapons* ſo Minute, that they could not contain but a very inconſiderable Portion thereof, if it were to be diſcharged that way.

To this purpoſe, I remember Mr. *Boyle* ſomewhere tells a Story of a Perſon Blinded by a Spider dropping its Venom into his Eye, which tho' it can hardly find credit with ſome, is however confirmed by what *Piſo* relates of his *Nhamdu*, viz. That in catching It great heed is to be taken leaſt Its Poiſon fall into the *Eye*, This cauſing a total loſs of the *Sight.*

What Mr. *Leewenhoek* obſerves of the Enmity theſe Creatures bear to one another I have often ſeen; for if Four, Five, or more be put together into a Glaſs, they immediately fall to *Fighting* with all the fury Imaginable; *Limbs* ſtruck off are uſually the *Præludes* to the terrible Slaughter, which continues till all are killed, the *Surviving Conqueror* himſelf moſt commonly Dying of his Wounds.

The *Weapons* of Miſchief in the *Scolopendra* are much the ſame with Thoſe of the Spider, only larger. One of Theſe Creatures I had brought to Me alive out of a Ship which came from the *Eaſt-Indies*, where *Bontius (d)* ſays, Their Bite is ſo painful that it makes People almoſt Mad; but it died before I had an opportunity of making Trial of Its Poiſon; however, I very diligently looked upon the *Claws (e)*, and found Them to have no more *Cavity* than is neceſſary for the inſertion of their Muſcles, nor any *Exit* or Out-let towards their *Apex*; theſe therefore ſerve only to *pierce* the Fleſh, and the Venom is infuſed from a *Proboſcis* out of the Mouth; tho' *This* I could not very well diſcern, becauſe the Parts had bin kept too long dry before I examined Them.

The Caſe is much the ſame with *Stinging* Animals; of Theſe *The Scorpion* is the Chief, whoſe *Virus* in different Countries is more or leſs dangerous, according as 'tis exalted by various Degrees of *Heat*; thus in *Africa* particularly Its Effects are ſo dreadful, that as *Joann. Leo* (*f*) tells Us, The Town of *Peſcara* there is in a manner left deſolate by the Inhabitants in the Summer time, by Reaſon of the great Abundance of theſe Creatures, certain Death ſollowing their *Sting*.

(d) *Hiſt. Ind.* p. m. 56.
(e) Vid. *Fig.* 17.

Some of this deadly kind (The ſame, tho' not ſo large with *That* in the *Eaſt-Indies*, of which *Swammerdam* (*g*) has given a very accurate Deſcription and Figure) Sr *Redi* had ſent Him from *Tunis* (*h*); and it being *November*, irritated Them to *Sting* Pigeons, Pullets, *&c.* without any bad Effect at all of their *Poiſon*; but upon the approaching Spring, One of *Them* which had bin kept all the Winter, nay, Eight Months, without any Food, and the Wound of whoſe Sting before was harmleſs, Stung to Death Two Pigeons ſucceſſively; but a Third and Fourth Wounded in like manner, ſuffered no hurt. Yet having let the *Scorpion* reſt all Night, He killed another Pigeon the next Morning.

(*f*) Hiſtor. Afric. *lib.* 6.
(*g*) Hiſt. Inſect. *p.* 147.
(*h*) Generazione degli Inſetti, *p.* 51.

At the *Point* of the *Sting* He very often could diſcern a ſmall drop of white *Liquor*, which when the Wound was made, entered into the Fleſh.

As This *Liquid Venom* is either not ſeparated from the Blood into the Cavity of the Sting, during the cold of Winter, or at leaſt the Scorpion wants ſtrength at that time to throw It out with Force and Energy. *So* even in the Hot Months, after It is exhauſted by Two or Three *Attacks*, the *Sting* is no longer hurtful, till the expence of This *Juice* is recruited by Time.

'Tis very Remarkable concerning this *Inſect*, what an Ingenious Gentleman who lived ſeveral Years in *Barbary* told Me he had many times Tried ; That if It be ſurrounded with a Circle of *Burning Coals*, It does, upon the ſenſe of the *Heat*, turn it ſelf violently every way to make an Eſcape ; but finding it impoſſible, and the *Pain* from the Fire Increaſing, It ſtrikes it ſelf Twice or Thrice with the *Sting* on the *Back*, and immediately Dies of the Wounds.

Others may make what Reflections They Pleaſe on This *Self-Murder*, It is to Me beyond all Diſpute ſufficient to decide the *Controverſie* between Writers, whether Poiſonous Animals of the ſame *Species* can Kill each other. Which is not only confirmed by what We before obſerved of the *Spider*, but is likewiſe true of *Vipers*; for Dr. *Herman* bringing from the *Indies* Three of the *Cobras de Capelo* all in one Glaſs, Two of Them were killed in the Voyage by *Fighting*.

As the *Viperine Venom* is the *Quinteſſence* and moſt active Part of thoſe *Animal Juices* with which the Viper is nouriſhed, ſo is alſo *That* of the Scorpion; for this Inſect lives chiefly upon *Locuſts*, &c. and the ſame Perſon from *Barbary* inform'd Me, That ſeeing oftentimes *Locuſts* ſticking up in the Ground as if they were *Set* there, by looking he found that ſome Part of them was always eat away, and that Theſe Places were the *Holes* of Scorpions who had dragg'd their Prey thither, and fed on It as they had Occaſion.

In like manner, *as* the *Axungia Viperina* Cures the Bite of the Viper, *ſo* alſo the *Oleum Scorpionum*, or Oil in which Scorpions have bin infuſed, is a preſent Remedy for the Sting of this Creature.

The Mechaniſm of the Sting of a *Bee* Dr. *Hooke* has very accurately deſcribed (*i*). One may with the naked Eye ſometimes ſee It diſcharge the *Venom*; and in *This*, by the help of a *Glaſs*, I can eaſily diſcover a great Number of Minute *Salts* Floating.

And indeed this *Apparatus* or Contrivance is ſo Univerſal, that we find even in *Vegetables* ſomething Analogous hereunto; for the laſt mention'd Author (*k*) has ſhewn Us, That the Pricking Points of *Nettles* do at the ſame time they pierce the Skin, inſtil a Venomous *Juice* into the Wound.

(*i*) Microgragh. Obſerv. 34.
(*k*) Ibid. Obſ. 25.

Eſſay the Second.

OF THE BITE OF THE TARANTULA AND Mad Dog.

I Join theſe Two *Poiſons* together, becauſe tho' they differ very much in their Effects, yet both do agree in this, that they induce a particular *Delirium ſui generis*, attended partly with *Maniacal,*

acal, partly with *Melancholy* Symptoms.

The *Tarantula* (of which the Figure may be ſeen in *Baglivi*'s Diſſertation (*a*)), is a *Spider* of *Apulia* of the *Octonocular* kind; that is of that *Species* that has Eight Eyes and Spins Webbs; it has Eight Legs, Four on each ſide, and in each Leg Three Joints; from the Mouth proceed Two Darts, in ſhape juſt like to a hooked Forceps, or Crab's Claws; theſe are ſolid, and very ſharp, ſo that they can eaſily pierce the Skin; and between theſe and the Fore-Legs there are Two little Horns, which I ſuppoſe do anſwer to thoſe Bodies called from their Uſe in *Flies* the *Feelers*; becauſe as they do, ſo this Creature is obſerved to move 'em very briskly when it approaches to its Prey.

This, as other Spiders do, propagates its *Species* by laying Eggs, which are very Numerous; ſo that there are found ſometimes in the Female, when diſſected, a Hundred or more; and theſe are hatched partly by the Heat of the Mother, partly by that of the Sun, in about Twenty or Thirty Days time.

(*a*) De Tarantul.

There is alſo a Spider of the like Nature with the *Tarantula* in the *Weſt-Indies*, which *Fr. Hernandez* (*b*) deſcribes by the Name of *Hoitztocatl*, or the *Pricking Spider*; and ſays, that its Bite induces Madneſs.

In the Summer Months, eſpecially when the Heats are greateſt, as in the Dog-Days, the *Tarantula* creeping among the Corn in the Fields, bites the Mowers and Paſſengers; in the Winter it lurks in Holes, and ſcarcely is ſeen; and if it does Bite then, it is not Venomous, neither does it induce any ill Symptoms.

But in the Hot Weather, altho' the Pain of its Bite is at firſt no greater than what is cauſed by the Sting of a Bee, yet the part quickly after is diſcoloured with a Livid, Black, or Yellowiſh Circle, and raiſed to an inflam'd Swelling; the Patient within a few Hours is ſeized with a violent Sickneſs, difficulty of Breathing, univerſal Faintneſs, and ſometimes Trembling, with a weakneſs of the Head; being asked what the Ail is, makes no reply, or with a Querulous Voice, and Melancholy Look, points to his Breaſt, as if the Heart was moſt affected.

(*b*) Hiſtor. Animal. Nov. Hiſpa. *Tract.* 4. c. 5.

During this mournful Scene all the uſual *Alexipharmick* and *Cordial* Medicines are of no Service; for notwithſtanding their repeated Uſe, the Patient growing by degrees more Melancholy, Stupid, and ſtrangely Timorous, in a ſhort time Expires, unleſs *Muſick* be called to his Aſſiſtance, which alone, without the help of Medicine, performs the *Cure*.

For at the firſt ſound of the *Muſical Inſtrument*, altho' the Sick lye, as it were, in an Apoplectick Fit, they begin by Degrees to move their Hands and Feet, till at laſt they get up, and fall to Dancing with wonderful Vigour, at firſt for Three or Four Hours, then they are put to Bed, refreſhed from their Sweating for a ſhort time, and repeat the Exerciſe with the ſame Vehemence, perceiving no Wearineſs or Weakneſs from it, but profeſſing they grow ſtronger and nimbler the more they Dance.

At this Sport they uſually ſpend Twelve Hours a Day, and it continues Three or Four Days; by which time they are generally freed from all their Symptoms, which do nevertheleſs Attack 'em again about the ſame time the next Year; and if they do not take Care to prevent this Relapſe by Muſick, they fall into a *Jaundice*, want of Appetite, univerſal Weakneſs, and ſuch like Diſeaſes; which are every Year increaſed, if Dancing be neglected, till at laſt they prove incurable.

As Muſick is the *Common* Cure, ſo they who are bitten are pleas'd ſome with one ſort of it, ſome with another; one is raiſed with a Pipe, another with a Tymbrel; one with a Harp, another with a Fiddle; ſo that the Muſicians make ſometimes ſeveral Eſſays before they can accommodate their Art to the Venom; but this is conſtant and certain, notwithſtanding this Variety, that they all require the quickeſt and briskeſt Tunes, and are never moved by a ſlow, dull *Harmony*.

While the *Tarantati*, or Affected, are Dancing, they loſe in a manner the Uſe of all their Senſes, like ſo many Drunkards, do many Ridiculous and Fooliſh Tricks, Talk and Act Obſcenely and Rudely, take great Pleaſure in Playing with Vine-Leaves, with Naked Swords, Red Cloths, and the like; and on the other Hand can't bear the ſight of any thing Black; ſo that if any By-ſtander happen to appear in that *Colour*, he muſt immediately withdraw, otherwiſe they relapſe into their Symptoms with as much Violence as ever.

It may afford ſome Light towards Underſtanding the Nature of this Poiſon, to obſerve that *Apulia* is the hotteſt part of all *Italy*, lying *Eaſtward*, and having all the Summer long but very little Rain to temper the Heats, ſo that the Inhabitants (as one of that Country obſerves (*c*)), do Breathe an Air, as it were, out of a Fiery Furnace; hence their Temperament is dry, and aduſt, as appears by their being generally Lean, Paſſionate, Impatient, ready to Action, Quick-witted, very ſubject to Inflamatory Diſtempers, Phrenſies, Melancholy, and the like, upon which account there are more Mad People in this, than in all the other Parts of *Italy*; nay, what in other Countries is but a light Melancholy, ariſes here to a great heigth; for Women in a *Chloroſis* do ſuffer almoſt the ſame Symptoms as Perſons Poiſoned by the *Tarantula* do, and are Cured the ſame way; and in like manner the Venom of the *Scorpion* does here in Effects and Cure agree very much with that of this *Spider*.

(c) Baglivi, *p.* 11.

From all this Hiſtory it ſufficiently appears, that thoſe who are bitten by a *Tarantula*, do thereupon become *Delirous*, and that in order to account for their ſurprizing Symptoms; the Nature of a *Delirium*, from which many of them proceed, ought to be underſtood.

Such is the Conſtitution of the *Humane Oeconomy*, that *as* upon the Impreſſion of outward *Objects* made upon the *Organs*, and by the Fluid of the Nerves conveyed to the *Common Senſory*, different *Species* are excited there, and repreſented to the Mind; *ſo* likewiſe upon this Repreſentation, at the Command and Pleaſure of the Soul, part of the ſame Fluid is determin'd into the Muſcles, and mixing with the Arterial Blood there, performs all the Variety of Voluntary Motions and Actions.

This Order has bin always ſo conſtant in Us, that at length by a kind of natural Habitude, without the Intervention of the reaſoning Faculty, Repreſentations made to the Mind do immediately and neceſſarily produce ſuitable Motions in the Bodily Organs. When therefore theſe Repreſentations are irregular, the Actions conſequent to them muſt neceſſarily be ſo too.

This being premiſed, it may perhaps be probably ſaid, that a *Delirium* is the Repreſentation and Various Compoſition of ſeveral *Species* to the Mind without any Order or Coherence; together, at leaſt moſt commonly, with irregular, or, as it were, undeſigned Motions of the Body; that is, ſuch a wandring and irregular Motion of the Nervous Fluid, whereby ſeveral Objects are repreſented to the Mind, and upon this Repreſentation divers Operations performed by the Body, tho' thoſe Objects are not Impreſſed upon the Organs, nor thoſe Operations or Motions deliberately Commanded by the Soul.

The Mind indeed is the firſt Principle of all Muſcular Motion; but in ſuch Caſes as theſe, its Promptitude to Action or Habit being ſo great, it is in a manner ſurpris'd, and cannot recover it ſelf after the Spirits are with violent force determin'd purſuant to the Repreſentations of the *Species*. For, *as* in the former State of Things a Man is ſaid to Act Rationally, *ſo* this latter Caſe is call'd a *Perturbation of Mind*, that is, a *Delirium*; tho' it is very manifeſt that in reality the Defect is not in the *Rational*, but *Corporeal* Part; ſuch *Species* being really preſented to the Mind, upon which, by the Order of our Conſtitution ſuch Motions ought to follow in the Body.

Thus for Inſtance, if the Liquor of the Nerves is, without the Preſence of any thing hurtful, put into a Motion like unto that which a painful Impreſſion makes in it, the ſame Bodily Actions muſt inſue as proceed from Fear, Anger, or the like Paſſion, determining the Spirits towards the Muſcular Parts; and a By-ſtander, who ſees no reaſon for ſuch a Repreſentation made to the Mind, will preſently conclude that the Perſon thus acting acts without or beſides his Reaſon, that is, is *Delirous*; eſpecially if the Hurry and Confuſion of the Spirits be ſuch, that not only *one*, but *ſeveral* different *Species* be at the ſame time preſented to the Mind; for a Man in this Caſe may act the Part of one Joyful, Angry, Timorous, or the the like, without any appearing Reaſon, and all this almoſt in the ſame Moment of Time.

In one Word, *Deliria* are the *Dreams* of thoſe who are *Awake*; and *as theſe* in Us *Sleeping* are infinitely various and wonderfully Compounded, and all from the ſame common *Cauſe*, diverſely preſſing the Orifices of the Nerves, and thus making different *Repercuſſions* of their

Fluid; and *as* we all know that this Confuſion making the Repreſentation of ſeveral *Species* to the Mind, there do hereupon follow, tho' the Body ſeem now at Reſt and in perfect Repoſe, ſuch Motions in the Organs as are uſually the Effect of the Arbitrary Determination of the Spirits thither; *ſo* We are now to enquire what Alteration of the Body made by this Venom, can be the occaſion of this Diſorder and Tumult in the Nervous Fluid, which excites in the Party infected ſuch Surprizing, and almoſt Contradictory, Repreſentations.

Moſt of the Symptoms of thoſe who are bitten by the *Tarantula* are at the Firſt, that is, before they riſe to a *Delirium*, plainly the ſame with thoſe which the Bite of a *Viper* induces; without doubt therefore, as we have before obſerved of the common Spider, that it peirces the Fleſh with its hooked *Forceps*, and at the ſame time inſtils from the *Proboſcis* in the Mouth a Liquid Venom into the Wound; ſo the like *Claws* in *This* (of which I have taken the Figure (*a*) out of P. *Bonanni*, very much magnified (*b*)) do ſerve to

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(*a*) Vid. *Fig.* 16.
(*b*) Micrograph. Curioſ. *p.* 69.

make way for an active and penetrating Juice emitted from the ſame part.

Of the Nature of which We may probably conjecture, that it is, when mixed with the Blood, being exalted by the Heat of the Climate, of ſo great Force and Energy, that it immediately raiſes an extraordinary Fermentation in the whole Arterial Fluid, by which its Texture and *Craſis* is very conſiderably altered; the Conſequent of which Alteration, when the Ebullition is over, muſt neceſſarily be a change in the *Cohæſion* of its Parts, by which the *Globules*, which did before with equal force preſs other, have now a very differing and irregular *Niſus* or Action, ſo that ſome of 'em do ſo firmly Cohere together, as to compoſe *Moleculæ*, or ſmall Cluſters; upon which account there being now a greater number of *Globules* contained in the ſame ſpace than before, and beſides, the *Impulſe* of many of *theſe* when united together differing according to the Conditions of their *Cohæſion*, as to Magnitude, Figure, *&c.* not only will the *Impetus*, with which this Fluid is drove towards the Parts, be at ſome Strokes at leaſt greater than ordinary; but the Preſſure upon the Blood Veſſels muſt be very unequal and irregular; and this more eſpecially will be felt in them which are moſt eaſily diſtended; ſuch are thoſe of the Brain, *&c.* And hereupon the Fluid of the Nerves muſt neceſſarily be put into various *Undulatory* Motions, ſome of which will be like unto thoſe which different *Objects* acting upon the Organs or *Paſſions* of the Mind, do naturally excite in *It*, whereupon ſuch Actions muſt follow in the Body, as are uſually the Conſequents of the ſeveral *Species* of Sadneſs, Joy, Deſpair, or the like Determinations of the Thoughts; and we ſhall readily pronounce one in this Condition, *Sad*, *Joyful*, *Timorous*, &c. and all without any apparent Reaſon or Cauſe; that is, in one Word, we ſhall ſay he is *Delirous*.

This is in ſome Degree a *Coagulation* of the Blood, which will the more certainly, when attended with an extraordinary Heat, as in the preſent Caſe, produce ſuch like Effects as theſe, becauſe the *Spirits* ſeparated from the Blood thus Inflamed, and Compounded of Hard, Fixt and Dry Particles, muſt unavoidably ſhare in this Alteration; that is, whereas their Fluid conſiſts of Two Parts, *One* more Active and Volatile, the *Other* more Viſcid and Glutinous, which is a kind of Vehicle to the former; their *Active* part will bear too great a Proportion to the *Viſcid*; and thus they muſt neceſſarily be of more than ordinary Volatility and Force, and will therefore, upon the leaſt Occaſion imaginable, be irregularly determin'd to every part; and hereupon will follow Tremblings of the Body, Anger or Fear upon a light or no Cauſe, extream Pleaſure at what is but a Trivial Entertainment, as Red, Green Colours, or the like; and on the other Hand, wonderful Sadneſs at any thing not agreeable to the Eyes, as Dark and Black Things; nay, Ridiculous Laughter, Obſcene Talk and Actions, and ſuch like Symptoms; becauſe in this Conſtitution of the Nervous Fluid, the moſt light Occaſion will make as real a *Reflux* and *Undulation* of it to the Brain; that is, will preſent as lively and vivid *Species* there, as the ſtrongeſt Cauſe and Impreſſion can produce in its natural State and Condition; nay, in ſuch a Confuſion, the Spirits cannot but ſometimes, without any manifeſt Cauſe at all, be hurried towards thoſe Organs, to which at other times they have bin moſt frequently determined; and every one knows which they are in Hot Countries and Conſtitutions.

We muſt however here Remember what in the former Eſſay we mention'd of the Fluid of the Nerves, being *immediately* altered by the Venomous Juice.

It will perhaps make this Theory more than probable, to conſider that *Baglivi* (a) in the Diſſection of a *Rabbit* kill'd by a *Tarantula*, found the Blood Veſſels of the Brain very turgid, and the ſubſtance of the Brain it ſelf, that is, the beginning of the Nerves, lightly inflamed, and with livid Spots here and there, the *Lungs* and other *Viſcera* diſtended, with concrete glotted Blood, and large grumes of Blood with *Polypous* Branches in the Heart, a large quantity of extravaſated *Serum* upon the Brain, which is (as he takes Notice) moſtly obſerved in thoſe Subjects which died by a Coagulation of the Blood.

Neither is it amiſs to remark, that in a *Chloroſis* there is nothing preternatural but an *infarctus* of the Arteries, and hence a retarded *Circulation*, from an evacuation ſuppreſs'd; and in this Country, too much Heat; that is, a beginning

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(a) *Pag.* 40.

Coagulation, together with an Inflammatory Diſpoſition.

In ſhort, *Bellini* has at large demonſtrated, how *Deliria*, as well *Melancholic* as *Maniacal*, do proceed from a State of the Blood and Spirits, not unlike to that I have here deſcribed.

But no leſs a Confirmation of theſe Notions may We have from the *Cure*; as to which it is obſervable, that the *Tarantati* have no Inclination to *Dance* before they hear the Muſick; for being ask'd to do it, they anſwer, It is Impoſſible, they have no Strength.

As for the Reaſon therefore of their ſtarting up at the firſt Noiſe of the Inſtrument, we muſt reflect upon what we have juſt now bin ſaying concerning the Cauſe of the Motions of the Body in a *Delirium*; and conſider withal, that Muſcular Motion is no other than a Contraction of the Fibres from the Arterial Fluid making an efferveſcence with the Nervous Juice, which by the light Vibration and Tremor of the Nerve, is derived into the Muſcle.

And thus we have a Twofold effect and operation of Muſick, that is, both upon the Mind and Body. For a brisk Harmony excites lively *Species* of *Joy* and

Gladneſs, which are always accompany'd with a more frequent and ſtronger Pulſe, or an increaſed influx of the Liquor of the Nerves into the Muſcles, upon which ſuitable Actions muſt immediately follow; and if we remember what we before hinted, that People in this Country are ſprightly and ready to Exerciſe; and that in ſuch a ſtate of the Fluids as we have deſcribed, a ſlight Occaſion preſents as ſtrong *Species*, as a greater can at another time: The Influence of Muſick on the *Mind* will appear to be ſo much the more powerful and certain.

As for the *Body*, ſince it is ſufficient for the purpoſe of putting the Muſcles into Action, to cauſe thoſe *Tremors* of the Nerves by which their Fluid is alternately dropt into the moving Fibres; it is all one whether this be done by the determination of the Will, or the outward *Impulſions* of an *Elaſtic* Fluid; ſuch is the *Air*; and that Sounds are the *Vibrations* of It, is beyond diſpute.

Theſe therefore rightly modulated may ſhake the Nerves as really as the *Imperium Voluntatis* can do, and conſequently produce the like Effects.

That This is ſo, beſides what we ſhall add anon, we may be convinced by a

Story which Mr. *Boyle* (*a*) relates out of *Scaliger*, of a Knight of *Gaſcony* whom the ſound of a *Bag-Pipe* would unavoidably force to make Water; for this Secretion we know is regularly the Effect of an Arbitrary Contraction of the Muſcles of the Bladder.

The obſtinate continuing of the *Tarantati* in this Exerciſe, is doubtleſs in a great Meaſure owing to the ſtrong Opinion they have of receiving Advantage from it, being incouraged by the By-ſtanders, and having always believed, and bin, told that it was the only Cure in theſe Caſes.

The *Benefit* from Muſick is not only their Dancing to It, and ſo evacuating by *Sweat* a great Part of the Inflammatory Fluid; but beſides this, the repeated Percuſſions of the Air hereby made, by immediate Contact ſhaking the Contractile Fibres of the Membranes of the Body, eſpecially thoſe of the Ear, which being continuous to the Brain, do communicate their Tremblings to its Membranes and Veſſels; by theſe continued Succuſſions and Vibrations, the *Cohæſion* of the Parts of the Blood is perfectly broken, and its

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(*a*) *Of Languid and Unheeded Motion.*

Coagulation prevented; ſo that the Heat being removed by Sweating, and the Coagulation by the Contraction of the Muſcular *Fribrillæ*, the wounded Perſon is reſtored to his former Condition.

If any one doubts of this force of the *Air*, let him conſider that it is in *Mechanicks* (*b*) Demonſtrated, that the ſmalleſt *Percuſſion* of the ſmalleſt Body, can overcome the reſiſtance of any great Weight which is in Reſt; and that the Languid Tremor of the Air, which is made by the Sound of a Drum or Trumpet, may ſhake the vaſteſt and ſtrongeſt Edifices.

But beſides all this, We muſt allow a great deal to the *determinate Force*, and particular *Modulation*, of theſe trembling Percuſſions; for contractile Bodies may be acted upon by one certain Degree of Motion in the ambient Fluid, tho' a greater Degree of It differently qualified may produce nothing at all of the like Effect; this is not only very apparent in the common Experiment of Two-String'd Muſical Inſtruments tuned both to the ſame Heigth, the Strings of the one being ſtruck upon, thoſe of the other will ſound, and yet a much greater Motion of the Air

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(*b*) Boelli De Vi Percuſſion. *Prop.* 90, *and* 111.

may not Cauſe any ſenſible Vibration at all in the ſame Chords; but alſo by the *Trick* which many have of finding the Tone or Note peculiarly belonging to any *Wine Glaſs*, and by accommodating their *Voice* exactly to that Tone, and yet making it loud and laſting, they will make the Veſſel, tho' not touch'd, firſt to Tremble, and then Burſt; which it will not do if their Voice be but a little either too low or too high.

This laſt Conſideration makes it no very difficult matter to conceive the reaſon, why different Perſons, infected with this Venom, do require oftentimes a different ſort of Muſick in order to their Cure, in as much as their Nerves and *Diſtractile* Membranes have differing *Tenſions*, and conſequently are not in like manner to be acted upon by the ſame *Vibrations*.

Nor are We to wonder at the Oddneſs of this Method and Practice; for *Muſick*, altho' it be Now-a-days applied to quite different Purpoſes, was anciently made great Uſe of for the removing of many, and thoſe too ſome of the moſt difficult and obſtinate Diſeaſes.

For this we have a Famous Teſtimony in *Galen* himſelf, (*a*) who tells us, that

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(*a*) De ſanitate Tuenda, *lib.* 1. c. 8.

Æſculapius uſed to recover Thoſe in whom violent Motions of the Mind had induced a hot Temperament of Body by Melody and Songs. Pindar (*b*) mentions the ſame thing; and indeed from hence not only the Notion, but the very Name of *Charming* (*c*) ſeems to have taken its Origine. *Athenæus* (*d*) relates that *Theophraſtus* in his Book of *Enthuſiaſm* ſays, *Iſchiadick Pains are Cured by the Phrygian Harmony.* This ſort of Muſick was upon a *Pipe*, and the moſt vehement and brisk of all the Ancients knew; ſo that indeed it was ſaid to raiſe thoſe who heard it to downright Fury and Madneſs (*e*): And ſuch we have obſerved to be required to the Venom of the *Tarantula.*

But what is beſides in this laſt Authority very obſervable to our Purpoſe, is the manner of uſing this Remedy, and that was (*f*) by *Playing upon the part affected*, which confirms what we have juſt now advanced concerning the Effect of the *Percuſſion* of the Air upon the Con-

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(*b*) Pythior. Od. 3. *μαλακαῖς ἐπαοιδαῖς.* Vid. ibid. Scholia.

(*c*) A Carmine.

(*d*) Deipnoſoph: *l.* 14. *p. m.* 624.

(*e*) Vid. Bartholin. de Tibiis Veter. *l.* 1. *c.* 9.

(*f*) *εἰ καταυλήσοι τὶς τοῦ τόπου τῇ φρυγιστὶ ἁρμονίᾳ.*

tractile Fibres of the Brain, for *Piping upon* any Member of the Body, cannot be ſuppos'd to do Service any other way, than by ſuch Succuſſions and Modulated Vibrations as We before mentioned. And this indeed *Cælius Aurelianus* (*a*) agrees to, who calls this Practice, *Decantare Loca dolentia*; and ſays, that the *Pain is mitigated and diſcuſs'd by the Tremblings and Palpitations of the Part.*

Aulus Gellius (*b*) not only relates this ſame Cure of *Iſchiadick* Ails as a thing notorious enough, but adds beſides out of *Theophraſtus*, that *the Muſick of a Pipe rightly managed healed the Bites of Vipers.*

And not only does *Apollonius* (*c*) mention the Cure of Diſtractions of the Mind, Epilepſies, and ſeveral other Diſtempers this ſame way; but *Democritus* (*d*) in his Treatiſe of Plagues, taught, that *the Muſick of Pipes was the Medicine for moſt Diſeaſes*; which *Thales* of *Crete* confirmed by his Practice, when ſent for by the *Lacedæmonians* to remove from them

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(*a*) Morb. chronic. *l.* 5. *c.* 1. Quæ cum ſaltum ſumerent, palpitando diſcuſſo dolore miteſcerent.

(*b*) Noct. Atticar. *l.* 4. *c.* 13.

(*c*) Hiſtor. Mirabil.

(*d*) Apud Aul. Gell. loc. citat. Plurimis hominum Morbis Medicinam fuiſſe Incentiones Tibiarum.

the Peſtilence; he did it by the help of Muſick (*e*).

All which Inſtances do evince this Remedy to have bin very ancient in many Caſes; and indeed as *Cælius Aurelianus* (*f*), takes notice that the firſt uſe of it was aſcrib'd to *Pythagoras* himſelf, ſo He having ſettled and founded his Sect in thoſe very Parts of *Italy* which are the Country of the *Tarantulæ*, going then under the Name of *Græcia magna*, now *Calabria*; it is not, I think, at all improbable that he may have bin the Author and Inventor of this Practice there, which has continued ever ſince. Eſpecially ſince *Jamblichus* affirms (*g*), not only that he made uſe of Muſick in Phyſick, but particularly that he found out and contrived ſome Harmonies to eaſe the Paſſions of the Mind, and others for the *Cure of Bites:* But of Muſick enough.

To conclude with this Poiſon, we may take notice that, as to the *Return* of the Symptoms the next Year, That is owing to the ſame exceſſive Heat in thoſe Months,

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(*e*) Plutarc. de Muſica.

(*f*) Loc. ante cit.

(*g*) De Vit. Pythagor. *cap.* 25. *πρὸς δηγμοὺς βοηθητικώτατα μέλη.*

acting again upon the ſmall remains of the Venomous *Ferment*; thus *Bartholin* (*i*) relates a Story of a Melancholy Phyſician at *Venice*, who ſuffered the Attacks of his Diſeaſe only during the Dog-days, which yearly ended and return'd with them. A convincing proof how great a ſhare Heat has in all theſe Caſes.

Of the Mad Dog.

MORE difficult and terrifying are the Symptoms from the Bite of a *Mad Dog*, whoſe Venom has this alſo ſurpriſing in it, that the bad Effects do not appear oftentimes till the Cauſe of 'em is forgot; for the Wound is as eaſily cured as a common Bite is; but neverthele ſs a conſiderable time after, a melancholy Tragedy ſucceeds, ſometimes ſooner, ſometimes later; for there are Inſtances of its being deferred to Two, (*k*) Six Months, nay, a Year, and longer, tho' the attack is generally

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(*i*) Hiſtor. Anatom. *Cent.* 2. *H.* 26.
(*k*) S. Ardoyn de Venen. *pag.* 381.

generally within Forty Days after the Wound; about that time, the Patient complains of Running Pains all over his Body, eſpecially near the Part wounded, like unto thoſe in a Rheumatiſm, grows penſive and ſad, prone to Anger upon little or no Occaſion, with an intermitting Pulſe, Tremblings and Contractions of the Nerves, with a great inward Heat and Thirſt; and yet in a few Days (when the Diſeaſe is come to its heigth) a Dread and Fear of Water, and any Liquor whatſoever; ſo that at the very ſight of it he falls into diſmal Convulſions and Agonies, and cannot drink the leaſt drop; and this *Hydrophobia*, or *Aquæ Timor*, has bin always accounted the ſureſt Sign and Mark of this Poiſon, as diſtinguiſhing it from all others.

The Antients have at large deſcribed theſe Symptoms, as *Galen*, *Dioſcorides*, *Aetius*, *Ægineta*, but moſt particularly of all, *Cælius Aurelianus* (*a*); and later Writers have given us ſeveral Inſtances of the *Hydrophobia*; Two Hiſtories of It publiſhed, the one by Dr. *Liſter* (*b*), the other by Dr. *Howman* (*c*), I ſhall more eſpeci-

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(*a*) De Morb. Acut. *lib.* 3.
(*b*) Exercitat. de Hydrophob.
(*c*) *Philoſoph. Tranſact.* No. 169.

ally take Notice of, and refer to, as containing the moſt exact and large account of any I have met with; he that deſires more, may conſult the ſeveral Authors cited by that diligent Obſerver, *Stalpart van der Wiel* (*c*).

That this Diſeaſe is accompany'd with a *Delirium*, is almoſt the common Opinion both of Ancients and Moderns; *Damocrates* called it the barking Phrenſie (*e*), but Dr. *Liſter* agrees in this Point with *Petrus Salius Diverſus* (*f*), and will not allow a *Delirium to* be the neceſſary conſequent of this Venom; and yet at the ſame time he tells us, that his Patient barked like a Dog, and bit at the By-ſtanders; that he threw into his Mouth what was given him more haſtily and ſuddenly than it is Natural or Cuſtomary for Men to do.

From ſuch Actions as theſe, together with thoſe mentioned before in relating the Symptoms, it is obvious enough to conclude, that Perſons thus affected are in a proper Sence *Delirous*. Tho' at the

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(c) Obſerv. Rarior. Centur. 2. obſ. 100.

(*d*) Vid. Galen de Theriac. ad Piſon, *l.* 1. *cap.* 16.

(*e*) Παρακοπὰν υλακτικὰν, apud Galen de Antidot. *lib.* 2. *cap.* 15.

(*f*) De Hydrophob.

ſame time I do think that the *Hydrophobia* it ſelf (whatever is commonly believed) does not at all proceed from this *Delirium*, as will by and by appear.

I know indeed that the main and plauſible *Objection* againſt a *Delirium* is this, that the Patient himſelf does Reaſon againſt his Timorouſneſs, tho' he cannot overcome it, forewarns the Standers-by of his Outrageous Fits, deſires them to take care of themſelves, and the like. Which from what I have already ſaid concerning a *Delirium*, appears to be very conſiſtent with it, nay, convinces that there is the greateſt Degree of it in this Caſe; in as much as that is not a Diſtemper of the Mind but of the Body. And to this purpoſe I remember to have ſeen my ſelf an Inſtance of one in a Feaver, who foretold ſome time before any ſigns of a *Delirium* were diſcovered, how raving and unruly He ſhould be, and made good his *Prognoſtick* to that Degree, that it was very hard Work to Tame and Maſter him; tho', as he told me afterwards, he reaſon'd a much as he could againſt that groundleſ Jealouſie of his Friends deſigning to Murder him, which put him upon hi

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Mad Actions, but was not able to Conquer the prevailing *Species* of Fear and Anger.

This *Delirium* therefore, as *Cælius Aurelianus* (g) ſays, *Proceeds intirely from an indiſpoſition of the Body*, which is without all doubt owing to the alteration made in the Blood by the *Saliva* of the *Mad Dog*, inſtilled into the Wound inflicted by the Bite.

That we may rightly underſtand this, we muſt take Notice, that the *Rabies* or Madneſs in a Dog is the effect of a Violent Feaver; and therefore it is moſt common in exceſſive Hot Weather, tho' ſometimes intenſe Cold may be the cauſe of it; That no Dog ever Sweats; from whence it follows, that when his Blood is in a Ferment, it cannot, as in other Creatures, diſcharge it ſelf upon the ſurface of the Body, and therefore muſt of neceſſity throw out a great many *Saline* and Active Particles upon thoſe Parts, where there is the moſt conſtant and eaſie Secretion; and ſuch next to the *Miliary* in the Skin in Us, are the *Salival* Glands; for this reaſon much more Spittle is ſeparated in a Dog when Mad, than at any other time, and that very frothy, or impregnated with Hot, Subtil Parts.

(g) Loc citat. Tota oritur ex corporis ipſius mala Affectione.

Now as we every Day obſerve, that what is thrown out from Liquors in a Ferment, is capable of inducing the like Motion in another Liquor of the ſame kind, when duly mixed with it; ſo we may very well ſuppoſe in the preſent Caſe, that the *Saliva*, which is it ſelf one of the moſt Fermentative Juices in Nature, being turgid with Fiery, Saline Particles thrown into it out of the boiling Blood, when it comes by means of a Wound to be Incorporated ~~with the~~ Arterial Fluid of any One, does by Degrees raiſe a preternatural Effervеſcence in It; The Effects of which will neceſſarily be moſt felt in thoſe Parts which being tender, are the leaſt able to reſiſt the diſtenſion of the Blood Veſſels, ſuch are the Stomach, and eſpecially the Brain; and hereupon *Deliria*, with *Maniacal*, and ſuch like Symptoms, will eaſily Inſue.

A Perſon thus affected may be ſaid in a Degree to have put on the *Canine* Nature, tho' his Reaſon be all this time untouch'd and intire, may Bite, Howl, *&c.* becauſe the *like* violent Agitation of the Blood in Him as was in the Dog will preſent like *Species*, and conſequently (ſo far as their different Natures will allow) produce like Actions; juſt as it has bin obſerved, that *Sheep* bitten by a Mad Dog, have run at the Shepherd like ſo many Dogs to Bite him; ſo much can an Alteration of the Blood and Spirits do. And as a Timorous Creature may be imboldened, ſo we oftentimes ſee Perſons Courageous enough by a change made in the Blood by Evacuations, that is, by want of Force and Motion in that Fluid, made ſheepiſh Cowards, in deſpight of their Reaſon, ſo long as that defect is continued.

But the main difficulties in this matter are, the Miſchief diſcovering it ſelf ſo long after the Bite, and the *Hydrophobia.*

As to the former we are to conſider, that Fermentation being a Change made in the Cohæſion of the compounding Parts of a Fluid, it is ſometimes a longer, ſometimes a ſhorter time before this Alteration is wrought; which variety may proceed either from the different Nature and Conſtitution of the Ferment, or of the Liquor Fermented, and a great Number of Circumſtances beſides. So that this Venom may be all the while doing its Work, tho' the change made by it may not be ſo conſiderable as to be ſenſibly taken Notice of till a long time after.

Nay, it may ſo happen, that the *Ferment* being Weak may not raiſe in the Blood any remarkable Agitation at all, till ſome accidental Alteration in the Body unluckily gives it an additional Force. As we before obſerved, how much external Heat concurrs to heighten the Symptoms from the Bite of the *Tarantula.* And this probably may be the Caſe of Thoſe in whom this Malignity has not appear'd till Six, or Twelve Months after the Wound.

That we may underſtand the Reaſon of the *Hydrophobia,* it is to be Remarked, that this dread of Water does not come on till the latter end of the Diſeaſe, Three or Four Days before Death; that is, not till this preternatural *Fermentation* in the Blood is come to its Heigth; and as in the Dog, ſo in the Patient, a great quantity of Fermentative Particles is thrown off upon the Glands of the Mouth and Stomach, as appears by his Foaming at the Mouth, *&c.*

As alſo, that this *Fear* is not from a ſight *of*, or any Imaginary appearance *in* the Water; for if the Veſſel be cloſe ſhut, and the Patient bid to ſuck thro' a Quill, as ſoon as he has taſted, he falls into Anguiſh and Convulſions, as Dr. *Liſter* obſerved. It is therefore highly probable, if not certain, that this ſurpriſing Symptom proceeds from the intolerable *Pain* which any Liquor at this time taken Induces, partly by hurting the inflamed Membranes of the *Fauces* in Deglutition; partly by fermenting with theſe Active Particles diſcharged by the Blood upon the *Stomachic* Glands, and thus twitching and irritating the Nervous Membranes; the very memory of which *grievous Sence*, after it is once felt, is ſo terrible, that the affected Perſon chuſes any thing rather than to undergo it a ſecond time.

The Effects of this *Irritation* are manifeſt in the Convulſions of the Stomach, and frequent *Singultus*, with which the Patient is continually oppreſs'd. And we all know by how neceſſary a kind of *Mechaniſm* we do fly from and abhor thoſe things which have bin proved diſagreeable to the *Animal Oeconomy*, to which nothing is ſo contrary and repugnant as *Pain*; at the firſt Approaches of which Nature Starts and Recoils, tho' Reaſon be arm'd with never ſo much Courage and Reſolution to undergo the Shock.

Nor will any Body wonder how this *Ferment* ſhould cauſe ſuch *Torment*, who conſiders how often, even in *Colical* Caſes, Perſons are downright diſtracted by exceſſive Pain from a Cauſe not unlike to this we are treating of, that is, from a corroſive Ferment in the Bowels, rarefying the Juices there into *Flatus*, and by this means irritating and ſtimulating thoſe tender Membranes into Spaſmodic and Convulſive Motions.

And indeed Dr. *Liſter*'s Patient told him, that the very *Swallowing* of his own Spittle put him to ſuch Torture in his Stomach, that Death it ſelf was not ſo Terrible as the Inexpreſſible Agony.

It may ſerve both to Illuſtrate and Confirm this Theory to take Notice, that not only may (according to theſe Principles) other Bites beſides that of a *Dog* happen to induce the like Symptoms; thus *Malpighi* (*a*) relates a Story of a Mother made *Hydrophoba* by the Bite of her *Epileptick* Daughter; but that there are other Caſes, without any Bite at all, which are attended with an *Hydrophobia*.

Thus *Schenkius* (*b*), *Salmuth* (*c*), and

(*a*) Oper. Poſthum. *p.* 55.

(*b*) Obſerv. de Venen. Animal.

(*c*) Obſerv. *Cent.* 2. *Obſ.* 52.

others, have obſerved a *Dread of Water*, without any Suſpicion of a Bite, from *Malignant Feavers*. Now in *Theſe* there is doubtleſs a Hot, Putrid *Ferment* in the Blood; and it is no wonder if Part of it be diſcharged upon the Throat and Stomach, which we do evidently find in theſe Diſtempers to be more particularly affected by It, eſpecially towards the latter End, from the *Aphthæ*, *Singultus*, and the like uſual Symptoms of a fatal Malignity.

Nay, *Hippocrates* (*d*) himſelf ſeems more than once to have remarked ſomething like this Symptom in Feavers, and to call thoſe who were thus affected Βραχυπόται, or Little Drinkers; for I cannot aſſent to Dr. *Liſter*, (tho' *Cælius Aurelianus* be on his ſide) who thinks that the Βραχυπόται are ὑδροφόβοι, from the Bite of a Mad Dog; as well for other Reaſons, as becauſe *Plutarch* (*e*) aſſures Us, that the *Hydrophobia* and *Elephantiaſis* were both firſt taken Notice of in the time of *Aſclepiades* the Phyſician; who liv'd in the Days of *Pompey* the Great,

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(*d*) In Prorrhetic. & coac. & alibi.

(*e*) Sympoſiac. 5. 9.

many Years later than either *Hippocrates* or *Ariſtotle.*

Neither is it amiſs to add, that *Joannes Faber* (*f*) in the Diſſection of one who died at *Rome* of the Bite of a Mad Dog, and a *Hydrophobia* ſucceeding it, found the Blood *Coagulated* in the right Ventricle of the Heart, the Lungs wonderfully *Red* and *Tumefied*; but eſpecially the *Throat*, *Stomach*, and *Bowels*, bearing the Marks of the Inflammatory Venom.

The ſame Obſervation has bin made by others in Bodies Dead of this Diſeaſe. Thus the *Acta Medica Hafnienſia* (*a*) relate one Caſe, in which, part of the Liver was *Inflamed*, the Lungs Parched and Dry, and the inner Coat of the *Stomach* ſo *Mortified*, that it might be abraded with one's Fingers.

Bonetus (*b*) tells *another*, where all the *Viſcera* were found quite *arid*, without any Juice at all.

And in a very particular Hiſtory of an *Hydrophobia*, lately publiſhed at *Ulm* (*c*) We are informed, that the *Stomach*

(*f*) Apud Hernand. & Recch. Plantar. & Anim. Mexicanor. Hiſtor. *pag.* 494.

(*a*) *Vol.* 5. *Obſ.* 114.

(*b*) Sepulcret. *Lib.* 1. *Sect.* 8. *Obſ.* 8.

(*c*) Roſſini Lentilii Diſſertatio de Hydrophobiæ Cauſa & Cura.

when opened, diſcover'd the Marks of an *Eroſion* or Excoriation, with ſomething like a Gangrene, and a Suffuſion of Blood here and there. Which does very well agree with the Obſervations in the *German Ephemerides* (*d*), where we find ſeveral *Footſteps* of a *Sphacelus* or Mortification in the Bodies of Thoſe who died *Hydrophobi.*

The Cure of this Poiſon is either immediately upon the Wound made, or ſome Days after, before the Fear of Water is diſcovered; for at that time all Authors do agree the Malady to be Incurable; and the Reaſon is plain from what has bin already delivered.

As in other Venomous Bites, ſo in this, *Galen* (*e*) very wiſely adviſes to inlarge the Wound, by making a round Inciſion about it, to Cauteriſe it with a hot Iron, and apply drawing Medicines, ſo as to keep it a running Ulcer at leaſt Forty Days. (*f*) *Scarifying* and *Cupping* may anſwer where this Severity is not allow'd: And however, the Dreſſing it with *Unguentum Ægyptiacum* (or the like)

(*d*) Eph. Cur. *Dec.* 3. *Ann.* 2. *Obſ.* 104.
(*e*) De Theriac. ad Piſon. *l.* 1. *c.* 16.
(*f*) Vid. Aetium. *l.* 6. *c.* 24.

Scalding Hot, muſt not be omitted; by which alone, timely applied, I am aſſured that one Bitten was happily preſerved.

But where theſe Means of deſtroying the Ferment in the beginning are omitted, the dangerous Conſequences of it being mixed with the Blood is by al poſſible Care to be prevented.

To this purpoſe, to ſay nothing of th many Inconſiderate Jumbles of *Antidotes Theriacas*, &c. nor of ſuch vulgar Trifle as the *Liver* of the Mad Dog, of whicl *Galen (a)* obſerved, that tho' ſome whc made uſe of it, together with other gooc Medicines, recovered, yet that they whc truſted to it alone died; one of th greateſt Remedies commended to us b Antiquity, is the *Cineres Cancrorum Fluviatilium*; which *Galen (b)* ſays, no Body ever made uſe of, and miſcarried; anc before Him *Dioſcorides (c)* aſſured, tha 'tis a Medicine may be rely'd on. Theſ were given in large Quantities, *viz.* good Spoonful or Two every Day fo Forty Days together, either alone, o rather mix'd with the Pouder of *Gen*

(a) Simpl. Medic. Facult. *l.* 11. *c.* 1.
(b) Ibid. *l.* 11. *c.* 34.
(c) Theriac. *Cap.* 2.

tian Root and *Frankincenſe.* The *Vehicle* was either Water or Wine. In like manner at this Day the Remedy in the greateſt Repute of any againſt moſt Poiſons in the *Weſt-Indies* is a kind of a *River Craw-Fiſh*, call'd *Aratu* (*d*).

This is manifeſtly an *Abſorbent*, and very *Diuretic* Medicine, eſpecially when prepared after the right manner, which was by Burning the Craw-Fiſh Alive upon a *Copper-Plate*, with a Fire made of the Cuttings or Twigs of *White Briony*: For whether the latter part of the Management ſignifies much or no, the former moſt certainly does; and the *Salt* of the *Copper*, which powerfully provokes Urine, being mix'd with that of the *Aſhes*, may very much exalt their Virtue.

And it is upon this ſame Score, that the *Spongia* of the *Cynorrhodos* or *Roſa Sylveſtris* is ſo Celebrated an Antidote, not only for this Poiſon, but alſo for that of the Viper, *Tarantula*, and others too, that 'tis call'd in *Sicily Sanatodos*, or All-heal; this being not a *Vegetable*, as P. *Boccone* (*e*), who has wrote a whole Letter of its wondrous Virtues, terms it,

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(*d*) Vid. Piſon. Hiſtor. Nat. & Med. Ind. *lib.* 5. *c.* 16.
(*e*) Muſeo di Piante rare *Oſſervaz.* 2.

but an *Animal Alcali*, as well as the former; for as Mr. *Ray* (*f*) has obſerved, this Spongy Excreſcence, if it be cut, is found full of White Worms; Being the Neſt of theſe Inſects, which lodging here all the Winter, do in the beginning of the Spring turn to Flies, and quit their Quarters. Indeed this Remedy was antiently too of ſo great Eſteem, that *Pliny* recommends it as the only Cure of an *Hydrophobia*, divinely diſcovered by an Oracle (*g*).

As all Inſects abound with a Diuretick Salt, ſo *Cantharides* more than any others; therefore the Learned *Baccius* (*h*) goes farther, and from the Authority of *Rhazes* and *Joannes Damaſcenus*, adviſes to give theſe in Subſtance for many Days together. The Preparation of this Antidote, (ſo he calls it) is by infuſing the *Cantharides* in Soure Butter-milk Twenty-Four Hours, then drying them, and with the Flower of Lentils and Wine making 'em up into *Troches* of a Scruple Weight, of which one is to be taken every Day. By which means he aſſures us, that tho' the Patient make bloody Urine, yet that

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(*f*) Hiſtor. Plant. *Tom.* 2. *pag.* 1471.

(*g*) Hiſtor. Natur. *l.* 8. *c.* 41. & *l.* 25. *c.* 2.

(*h*) De Venen. *p.* 80.

Milk largely drank will abate that Symptom, and that an *Hydrophobia* will be happily prevented. *Boccone (i)* tells Us, That in *Upper Hungary* They give *Cantharides* to Men bitten by a Mad Dog, *Five* to a Doſe; and to *Beaſts* in greater Quantity. But of the inward Uſe of theſe Flies more in its proper Place.

In ſhort, all the *Specificks* in this Caſe are ſuch as do either abſorb a peccant *Acidity* in the Stomach, or carry it off by Urine; as *Terra Lemnia*, highly commended by *Galen (k)*, *Garlick*, *Agrimony*, *Oxylapathum*, and many others, of which a Catalogue may be ſeen in *S. Ardoynus*. So the *Alyſſum* or Madwort celebrated for this uſe by the Ancient Phyſicians, as well *that* deſcribed by *Dioſcorides*, which is a Species of *Leucoium*, as the other of *Galen*, which is a *Marrubium*, is very manifeſtly a Bitter, Stomachic, and Diuretic Plant *(l)*. The *Lichen cinereus terreſtris*, recommended in the Philoſophical Tranſactions *(m)*, Operates the ſame way.

(*i*) Muſeo di Fiſica, *Oſſervaz*. 21.
(*k*) Medicam. facult. *lib*. 9. *c*. 1.
(*l*) Fab. columnn. Phytobaſan. *p*. 27.
(*m*) No. 237.

But the greateſt and ſureſt Cure of all, is frequent *Submerging* or Ducking the Patient in Water. The firſt mention I find of this is in *Cornelius Celſus* (*n*); whether he had it from the Ancient Grecian Phyſicians, or it was the Diſcovery of his own Age, matters but little to our Purpoſe; certain it is that he collected his Principal Rules of Bathing from *Cleophantus*, who, as *Pliny* ſays (*o*), did, beſides many other delightful things, firſt introduce the Uſe of Baths; As appears by comparing the Writings of the *One* with the Fragments of the *Other*, preſerv'd in the Works of *Galen*. And that from *Aſclepiades*, who afterwards ſo far improved this Part of Phyſick, that he diſcarded almoſt all inward Medicines, he might learn this Management,is not improbable; for the *Hydrophobia* (as we before took Notice) having bin firſt regarded in the time of this great Phyſician, 'tis very likely that among other Advantages of his new Method, he might commend it for the Cure of ſo deplorable a Malady.

(*n*) Lib. 5. c. 27.
(*o*) Nat. Hiſt. *l.* 26. c. 3.

However it be, This Practice was in this laſt Age with great Authority revived by the Ingenious *Baron Van Helmont* (*a*), who having in his own Country ſeen how great Service it did, has at large ſet down both the manner of the Operation; and, Conſonant to the Principles of his own Philoſophy, ſhewn the Reaſon of its good Effects. Since him *Tulpius* (*b*), an obſerver of very good Credit, takes notice, that tho' he ſaw many, yet that never one miſcarry'd, where it was in time made uſe of.

As all Baths do chiefly act by the ſenſible Qualities of Heat and Cold, and the Gravity of their Fluid; ſo we need go no farther to fetch the Reaſon of the great Advantage of this Method in the preſent Caſe, than to the preſſure of the Water upon the Body of the Patient.

Every one knows how plentifully plunging into cold Water provokes Urine, which proceeds no doubt from the conſtriction hereby made of the Fibres of the Skin and Veſſels. Thus this outward Cure differs not much in effect from the inward Medicines beforementioned, but muſt neceſſarily have the better of them

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(*a*) Tr. Demens *Idea.*
(*b*) *Obſerv.* 20.

in this Reſpect, that when the Fermenting Blood ſtretches its Veſſels, the exceeding weight of the ambient Fluid reſiſts and repreſſes this Diſtenſion, and ſo prevents the Effects of It. For this Reaſon the Salt Water of the Sea is eſpecially choſen for this Buſineſs, becauſe its greater Gravity than that of Freſh does more powerfully do all this, and break the beginning Cohæſion of the Parts of the Blood.

Thus we may, without having recourſe to the *Fright* and Terror, with which this Method, when rightly practis'd, (by keeping the party under Water for a conſiderable time, till he is almoſt quite drowned) is uſually accompanied, probably enough account for the Advantages of this Immerſion. Tho' it is not unlikely that this new Fear may have ſome good Effect in the Caſe too, for not only Convulſions, but Agues, and other Diſeaſes, have oftentimes bin happily Cured, merely by terrifying and ſurpriſing the Patient.

The Reaſon of this will eaſily be underſtood by him who knows what Alterations the Paſſions of the Mind do make in the Fluid of the Nerves and Arteries; of which in another Place.

It may for our preſent purpoſe ſuffice to take Notice, that as in Conſideration of the laſt mentioned Effect upon the Mind, *Van Helmont* commends this ſame Practice in all ſorts of Madneſs, and Chronical *Deliria*; ſo upon the account of the before hinted Alterations on the Body, Bathing was, among the Ancients, the common Cure of Melancholy, and ſuch like Diſtempers (*c*). And as the younger *Van Helmont* (*d*), to confirm his Father's Notion tells, Us, that one Dr. *Richardſon* did with wonderful Succeſs make uſe of this Management in theſe Caſes, ſo in like manner *Proſper Alpinus* (*e*) takes Notice, that the Egyptians do at this Day perfectly recover Melancholy Perſons by the ſame Method, only with this Difference, that they make their Baths Warm.

He that compares what has bin already advanced concerning *Deliria*, with the *Bellinian* Theory of Melancholy and Maniacal Diſtempers, and reflects upon the Nature of Baths, and their manner of Acting, will ſee ſo much Reaſon in this Practice, as to be ſorry that 'tis Now-a-

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(c) Vid. Aretæum Cappad. Cur. Diut. *l.* 1. *c.* 5. Et Aetium. *l.* 6. *c.* 11.
(d) *Tr. Man and his Diſeaſes.*
(e) Medicin. Ægyptior. *l.* 3. *c.* 19.

days almoſt quite laid aſide and neglected. For we muſt obſerve, that altho' there be ſome difference in the Treatment and Cure of *Deliria*, whether maniacal or melancholy, when they are Originally from the Mind, as the Effects of Care Trouble, or the like, and when from an Indiſpoſition of the Body; yet that both do agree in this, that they require an Alteration to be made in the Blood and Spirits; inaſmuch as the Mind by often nay, almoſt continually, renewing to i ſelf any one *Idea*, of Love, Sorrow, *&c* does ſo conſtantly determine the Spirit and Blood, one and the ſame way, tha the Body does at laſt as much ſhare in th Alteration, as if it had bin primarily affected, and conſequently muſt have i ſome manner the ſame Amendmen Upon this ſcore *Baccius* (*f*) aſſerts the admirable uſe of Temperate Baths in a kind of Diſtractions; and aſſures us, tha not only common *Deliria*, but even th *Dæmoniaci*, *Phanatici*, *Lycanthropi* themſelves, *&c.* are cured by frequent Waſhings in freſh Water, and a Moiſt an Nouriſhing Diet.

(*f*) De Therm. *l.* 7. *c.* 22.

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But to inſiſt upon this Subject is foreign to our purpoſe; only in regard that the moſt uſual Methods of Cure in theſe Caſes are ſo very tedious, and oftentimes unſucceſsful at the laſt, I thought it not amiſs to hint thus much, in order to the advancing ſomething more Certain and Effectual towards the removal of the greateſt Unhappineſs to which Mankind is liable.

To conclude with the *Hydrophobia*; where theſe Remedies fail, or are Adminiſtred too late, the Patient, from the prevailing inflammatory diſpoſition of the Blood, grows more and more *Delirous*, and by Degrees downright raving Mad, at laſt (as it moſt commonly happens in Maniacal People) ſuffers a total Reſolution of Strength, and Dies. Thus Dr. *Howman*'s Caſe ended in a perfect univerſal *Paralyſis*.

Eſſay the Third.

OF
Poiſonous Minerals
AND
PLANTS.

ALtho' there be a great variety of Internal *Poiſons*, as well *Mineral* as *Vegetable*; yet they do all of 'em ſeem to agree in their Primary Effects, and Manner of Operation; and as the Teeth or Stings of *Venomous* Animals do conſtantly infuſe a Juice into the Wound they make, by which the Maſs of Blood is infected; ſo the Force of *Theſe* is chiefly confined to the Stomach and

Primæ Viæ; and tho' It may in ſome Caſes be Communicated Farther, yet the Principal Miſchief is done in Theſe Parts.

Deleterious Medicines, ſays Dioſcorides, *are many, but the Alterations made by them in the Body, common, and but few* (*a*).

Of all this kind, thoſe of a *Mineral* Nature are the moſt violent and deadly, the greater Gravity and Solidity of their Parts giving to theſe a Force and Action ſurpaſſing the miſchief of *Vegetable* Juices; and therefore whereas noxious Plants do vary their Effects in different Creatures, ſo as to prove harmleſs, nay, perhaps Beneficial and Nutritive to ſome, as Hemlock they ſay is to Goats (*b*) and Starlings (*c*), and Henbane to Hogs (*d*), the Strength of the Stomach in Theſe Animals being ſufficient to Conquer and Divide ſuch Corroſive Subſtances, and their Blood perhaps requiring to be recruited by ſuch warm and active Particles; A Mineral Malignity is not, at leaſt ſo far

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(*a*) *Ποικίλα μὲν γὰρ τὰ δηλητήρια φάρμακα, κοιναὶ δὲ καὶ ὀυ πολλαὶ ἐξ ἀυτῶν γινόμεναι διαθέσεις.* Alexiph. *p.* 399.

(*b*) Lucret. *lib.* 5.

(*c*) Galen. Simpl. Medic. *l.* 3. *cap.* 18.

(*d*) Sext. Empiric. Hypoth. Empiric. 1.

as we know, conquerable by any, but becomes univerſally hurtful and deſtructive.

We ſhall here give the firſt Place *to Mercury Sublimate.*

This is no other than a Mixture of *Quickſilver* with *common Salt*. The way of preparing it, as 'tis made at *Venice*, from whence great quantities are ſent into other Countries, *Tachenius* has given Us in his *Hippocrates Chymicus* (*e*); as to which we muſt obſerve, that tho' there be always added a proportion of *Salt-Petre*, and *Calcin'd Vitriol* to the other Ingredients, yet theſe do not enter into the Compoſition, but only ſerve to facilitate the Work; as abundantly appears from this Experiment, That Mercury ſublim'd with the ſame Proportion of Nitre and Vitriol without *Marine Salt*, neither receives any increaſe of its Weight, nor acquires any malignant quality.

The Effects of this *Poiſon* when taken are, violent Griping Pains, with a diſtenſion of the Belly, Vomiting of a ſlimy, frothy Matter, ſometimes mixt with Blood, and Stools of the ſame, an intolerable Heat and Thirſt, with cold Sweats,

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(*e*) *Cap.* 24.

Tremblings, Convulſions, *&c.* as will appear from the following Hiſtory *(f)*.

To a large Dog was given a Drachm of *Mercury Sublimate*, mixt with a little Bread; within a quarter of an Hour He fell into terrible Vomitings, caſting up frequently a Viſcid, frothy *Mucus*, every time more and more Bloody, and purged the ſame downwards; till tired and ſpent with this hard Service, He lay down quietly as it were to Sleep, but Died the next Morning.

The *Abdomen* being opened, a great quantity of extravaſated Blood was found between the Liver and Stomach, and between the duplicature of the *Omentum* about the Stomach; the Guts as well as the Stomach were diſtended, and full of a frothy Bloody *Mucus*; on the outſide they were of a livid Colour, within all over red, and inflamed down to the very *Rectum*; The Fibrous Coat of the Stomach being taken off, between that and the Nervous one, grumous Blood was found in ſeveral Places; the like was diſcovered here and there in the Inteſtins between the ſame Coats.

(f) Wepfer de Cicut. Aquatic. *pag.* 300.

The ſame *Symptoms* with theſe, and manifeſt Signs of a burning Corroſion follow'd with *Ulcers* in the Bowels, *Baccius (g)* obſerved in a young Man Poiſon'd by *Sublimate*, mixt with his Meat.

What we are here chiefly to examine is, how from Ingredients ſingly Innocent and Harmleſs ſo Miſchievous a Compound can reſult; for as the Caſe is very plain with reſpect to *Salt*, ſo is it likewiſe now Notorious enough, that *Quickſilver* it ſelf, which the Ancients, *Dioſcorides*, *Galen*, *Pliny*, &c. have unjuſtly rank'd among Poiſons, is in many Diſeaſes inwardly taken of very ſafe and beneficial Uſe; and that not only when diſguiſed with *Sulphur*, *Sugar*, &c. but *Crude*, without any Correction, or vainly pretended Mortification.

This the *Arabian* Phyſicians firſt gave the hint of, *Avicen (h)* having obſerv'd, that *They who drink It in a large quantity receive no hurt, its weight making a free Paſſage thro' the Body.* This was Incouragement enough for the Practice of giving whole Pounds of It in the *Iliac*

(g) De Venen. *p.* 21.

(h) Can. Medic. *l.* 4. *Fen.* 6. Argentum Vivum plurimum qui bibunt non læduntur eo; egreditur enim cum diſpoſitione ſuâ per inferiorem regionem.

Paſſion; which is oftentimes done with good Succeſs, without any frightful Symptom accompanying the Advantage received from its Ponderoſity.

Afterwards it plainly appear'd that this Mineral, tho' not taken in ſo great a Doſe as could immediately force its way thro' the Inteſtins, even when it was lodged for ſome time in this or that Part, was not at all hurtful by any Corroſive or Malignant Quality. And *Fallopius* (*i*), *Braſavolus* (*k*), with others of great Note, confirmed its harmleſs Efficacy in the Cure of the *Worms*, not only in adult Perſons, but even in the more tender Conſtitutions of Children.

Nor are theſe the only Caſes in which good Service may be had from this Weighty Fluid; he that rightly conſiders the State of the Animal *Oeconomy*, the various Alterations it ſuffers from the Stagnation of its more Viſcid Juices in the ſmalleſt Canals, and how much the Impulſe and Force of the Circling Blood, by which Obſtructions are to be removed, muſt be increaſed by its carrying along with it ſuch Particles as the

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(*i*) De Morb. Gallic. *Cap.* 26.
(*k*) Vid. Angel. Salam in Hemetolog. *p. m.* 504.

Mercurial Globuli, will perhaps ſee good reaſon to allow, that the prudent and cautious Management of *Quickſilver* may do that in ſome obſtinate and dangerous Diſeaſes, which we cannot promiſe our ſelves from any other of our known Medicines whatſoever.

But I am not to inſiſt on this Head; and the learned *Author* of the *New Theory of Fevers* (*l*), has already moſt ingeniouſly explain'd the *Mechaniſm* by which ſuch Effects as theſe are produced in the humane Body. It ſuffices to my preſent purpoſe, to have proved that pure *Mercury* is not Poiſonous or Corroſive; and therefore not only have I ſeen Two Ounces of It given every Day for One and Twenty Days together, without any Inconvenience at all; but found once ſome quantity of It in the *Perinæum* of a Subject I took from the Gallows for a Diſſection, (whoſe rotten Bones quickly diſcovered what Diſeaſe it was had required the Uſe of it, and that I ſuppoſe chiefly in External Application by Onction) without any Marks of Corroſion of the Part where it was lodged.

(*l*) *Pag.* 91. & ſeq.

Tho' withal we may upon this Occaſion remark, that the extreme Gravity of this Mineral alone, however ſerviceable it may be in other Reſpects; yet when it happens in ſo great a Quantity to Obſtruct the Capillary Ducts, as that the Force of the Circling Fluid is not ſufficient to Waſh it away, muſt neceſſarily induce Symptoms troubleſome and bad enough, as *Spaſms*, *Contractions*, *Palſies*, &c. which They do commonly Experience, who have either bin too often dawbed with *Mercurial Ointments*, or for a long time imploy'd in rubbing the *Quickſilver* upon *Looking-Glaſſes*; for the Internal Uſe of It will never produce any ſuch Miſchiefs.

As for *Sublimate* then, moſt certain it is, that the *Saline* Particles do impart to the *Mercury* this Malignant Quality; or to ſpeak more properly, That the *Salt* receives from the *Mercurial Corpuſcles* ſuch an increaſe of its Gravity and *Momentum*, as renders its Cutting Corroſion more Effectual and Penetrating; for the manner after which this Matter is done, is plainly this.

The *Globules* of the *Mercury*, tho' ſo minutely divided by the Action of the Fire, as to riſe in the form of a *Fume*, yet are ſtill Solid and Ponderous Bodies; 'tis all one to the preſent purpoſe, whether We ſuppoſe 'em perfectly *Sphærical*, or with the Learned *Gulielmini* (*a*) *Sphæroidical*, for in both Caſes, by reaſon of their extreme Parvity, being perhaps Simple and Elementary Bodies, they will eaſily be lodged in the Pores and Interſtices of the *Saline Cryſtals*; which being compos'd of the *Atoms* of *Salt*, variouſly by *Sublimation* combin'd and united, are a kind of Cutting *Lamellæ* or Blades; the force of which could never have bin very penetrating, upon the account of their lightneſs and eaſie Diſſolution, if the *Mercury*, without blunting their Edge or breaking their Figure, did not lend 'em an Additional Weight, and thus at the ſame time ſtrengthen their Action, and prevent their quick Solution by the Juices of the Stomach; which cannot now disjoin their Compounding Parts, becauſe the Vacuities into which they ſhould, in order to do this, inſinuate themſeles, are already poſſeſt and taken up by the *Mercurial Globules*.

In ſhort, Theſe *Cryſtals*, which are to be conſidered as ſo many ſharp Knives or

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(*a*) Trattato de Fiumi. *Cap.* 1.

Daggers, Wounding and Stabbing the tender Coats of the Stomach, and thus cauſing exceſſive Pains, with an Abraſion of their Natural *Mucus*, and (upon the conſtant Senſe of Irritation) continual Vomitings, *&c.* muſt of neceſſity, ſticking here and there in the capillary Veſſels, ſtop the Paſſage of the Blood in ſeveral Places, whereupon it Stagnates, and there follow little Inflammations, which growing higher and higher, terminate quickly in perfect Ulcers and Gangrenes; and theſe tho' ſingly very ſmall, yet many in number, do all together make up one continued and incurable Mortification.

This being the Nature of *Sublim'd Mercury*, it may not be amiſs to enquire, how it comes to paſs, That This ſame Compound reſublim'd with *live Mercury* in the Proportion of Four Parts to Three, (for the *Sublimate* will not take up an equal quantity) eſpecially if the work be repeated Three or Four times, loſes its Corroſiveneſs to that Degree as to become not only a Safe, but, in many Caſes, a Noble *Medicine.* For I do not ſee that any of the Chymical Writers have hit upon the true Solution of this *Phænomenon.*

Here then it is to be conſidered, That the Action of the *Saline Cryſtals* depending upon their Solidity and Largeneſs, theſe muſt neceſſarily, by every ſubſequent Sublimation, be broken into ſmaller and ſmaller Parts; the *Mercurial Globules* (for the Reaſons given by the *Author* (*a*) of the forementioned *Theory of Fevers*) ariſing more quickly and eaſily than the *Salts*, quit the Interſtices in which they were lodged, and the *Cryſtalline* Blades are divided every time more and more by the force of the Fire; whereupon a new Combination of Parts ſucceeds; and altho' there be a greater Proportion of the *Mineral* to the *Salts* than before, which makes *Dulcify'd Mercury* Specifically heavier than the *Corroſive*; yet the broken pieces of the *Cryſtals* uniting into little Maſſes of differing Figures from their former Make, thoſe Cutting *Points* which were before ſo ſharp, are now either quite loſt, or at leaſt, by reaſon of their Bluntneſs, cannot make Wounds deep enough to be equally miſchievous and deadly; and therefore do only Vellicate and Twitch the ſenſile Membranes of the Stomach to that Degree, as ex-

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(*a*) *Pag.* 93.

cites 'em to an Excretion of their Contents and Glandular Juices, upwards or downwards, according as the force of Irritation is greater or leſs.

Thus a violent *Poiſon* is mitigated into a *Vomit* or *Purge*; nay, it may eaſily happen (eſpecially in Robuſt Conſtitutions, and if the Bowels be at the ſame time by any means defended againſt the Stimulating Power of the Medicine) that this Twitching may be ſo ſlight, as to be almoſt inſenſible, and hardly troubleſome; and then the *Mercurial Globules* being freed indeed from moſt of the *Saline Parts* in their Paſſage thro' the *Primæ Viæ*, but ſtill having a mixture of ſome few of 'em, are quickly conveyed into the Blood, where by their Motion and Weight they muſt neceſſarily diſſolve the Preternatural Cohæſions of all the Liquors, particularly of Thoſe which Circulate in the ſmalleſt Canals, and are moſt Viſcid and Tenacious, making them more Fluxile and Thin, or of more eaſi Secretion; whereupon all the Glands o the Body are, as it were, ſet to Work, an Scoured of their Contents; but the *Salival* Ones eſpecially, being many i Number, very large and wide, and th Juice they ſeparate of a Tough and Ropi

Subſtance, ſo that a conſiderable quantity of It is accumulated before it is forced out at the Orifices of the Ducts: Theſe Effects will be moſt remarkable in *Them*, and a *Salivation* or Spitting muſt continue ſo long, till the Active Mineral Particles are thro' theſe and the other Paſſages diſcharged out of the Body.

As the Difference between Mercury *Corroſive* and *Dulcified* lyes in a greater and leſſer Degree of Operation and Force, ſo this ſame Conſideration diſtinguiſhes the ſeveral *Preparations* of this Mineral from each other; which tho' very many, yet do all vary their Effects in the Body, only according as the *Mercurial Globules* are differently combined with *Salts*, and the *Points* of *Theſe* more or leſs broken by the Action of the Fire, in the Burning of Spirits upon Them, and ſuch like Managements: And therefore however dignified with the great Names of *Arcana, Panacææ, Princes Pouders*, &c. They do not afford Us any thing Singular and Extraordinary, beyond what we may with equal Advantage promiſe our ſelves from ſome or other of the moſt common and uſual *Proceſſes*.

Thus much of *Mercury*. Let Us in the next place examine *Arſenick*, about the Nature and Compoſition of which Authors are very much puzzled.

This, in ſhort, is either *Native* or *Factitious*, and each of Three ſorts, *Yellow*, *Red*, and *White*. The *Native Yellow* is what the *Latins* called *Auripigmentum*; and this *Olaus Wormius* (*b*) makes Threefold. The *Red* is the *Sandaracha* of the *Greeks*. The *White* was not known to the Ancients; and indeed *Theophraſtus* ſeems only to have known the *Red*; but *Dioſcorides* deſcribes both *Red* and *Yellow*: *Nicander* had no Knowledge of either: The only Mineral Poiſons He mentions are *Litharge* and *Ceruſs*.

Orpiment and *Sandaracha* differ only by their greater or leſſer Concoction in the Earth; and therefore from *Orpiment* Boiled in a cloſe Pot Five Hours in a Furnace Fire, is made the *Factitious Sandaracha*, as perfect as the *Natural* (*c*).

The *Factitious Yellow* is made from the Cruſts of the *Natural Orpiment* (*d*).

(*b*) Muſeum, *p.* 28.

(*c*) Agricola de Natura Foſſil. *p. m.* 592.

(*d*) *Idem*, *Ibid.*

The *Native White* is more rare, but found plentifully in ſome Silver Mines in *Germany* (*e*).

But the *White Factitious* is of the moſt common Uſe of all; and it is, as *Agricola* tells us, no other than *Orpiment* again and again ſublimed with an equal part of *Foſſile Salt*, till it is brought to a Whiteneſs.

Orpiment and *Sandaracha* are moſtly found in Mines of Gold; and all Metallic Writers do agree them to be the beſt Signs of the Richneſs of the Vein. This is Ground ſufficient for the *Chymiſts* to take *Arſenick* for the Subject Matter of their great Work, as they call It; and they have very fondly accommodated ſome Ænigmatical Lines in the *Sibylline Oracles* (*f*) to this *Mineral.* Tho' the Interpretation be ſtrained, and not fairly made out, (the *Author* of theſe Verſes, whatever he might mean, being indeed Diſcourſing of the Name of the *Divine*

(*e*) Block Scrutinium Arſenici, §. *XIV.*

(*f*) *Lib.* I.
Εννέα γράμματ᾽ ἔχω, τετρασυλλαβός εἰμι, νόει με.
Αἱ τρεῖς αἱ πρῶται δύο γράμματ᾽ ἔχουσιν ἑκάστη,
Η λοιπὴ δὲ τὰ λοιπὰ, ϗ εἰσὶν ἄφωνα τὰ πέντε.
Τοῦ παντὸς δ᾽ ἀριθμοῦ ἑκατοντάδες εἰσὶ δὶς ὀκτώ,
Καὶ τρεῖς τρὶς δεκάδες.

Power it ſelf) yet very true it is, that this great Expectation from *Arſenick* is as old at leaſt as *Caligula*; that is, of more ancient Date conſiderably than the far greateſt part of thoſe Suppoſititious and Ill-contrived Compoſitions which do now bear the Name of *Oracles*: For that Covetous Emperor, as *Pliny* relates (*g*), ordered a great quantity of *Orpiment* to be wrought upon, that He might extract *Gold* out of It, and made ſome; but as it uſually happens in ſuch like Attempts, the quantity did not anſwer the Expence.

It is more to our purpoſe to take notice, that the later *Pretenders* to this *Philoſophy*, by finding their three *Principles*, *Salt*, *Sulphur*, and *Mercury* in this Body, will lead Us into its true Nature and Compoſition.

For whether We take *Orpiment* or *Sandaracha*, either of them will afford a *Regulus* or Mercurial Subſtance, more pure than that of *Antimony*. The manner of extracting It *Lemery* (*h*) has taught; and to This indeed the Mineral owes its great Ponderoſity.

(*g*) Nat. Hiſt. *l.* 33. *c.* 4.
(*h*) Cours de Chymie, *Part* 1. *Chap.* 10.

The Inflammability and Smell of *Arſenick* are ſufficient Proofs of its abounding *Sulphur*, which may without much difficulty be ſeparated from It (*i*).

That It conſiſts of ſome *Saline Parts* we are aſſured by Its Solution in common Water (*k*); and it is upon the account of Theſe that It does more happily promote the *Flowing* of Metals than any other *Salt-Pouders* which the Workmen make uſe of: Wherefore ſome have called It a coagulated *Aqua Fortis.*

From all this it appears, that Authors do vainly Diſpute wherein the Noxious quality of *Arſenick* reſides, ſince the Caſe here is plainly much the ſame with that of *Sublimate Corroſive*; and as the Salts there together, with the Mercurial Particles, do compoſe pungent *Cryſtals*, ſo without all doubt the *Regulus* of this Mineral gives a like force to the *Saline Bodies*, which without this weight could be but of ſmall Effect. The main difference is, that in *Arſenick* we have an addition of *Sulphur*, which does not only ſtrengthen the Action of the other Parts, in that as a *Vinculum* it keeps them united together;

(*i*) Lemery, *ibid.*

(*k*) Vid. Eman. Konig Regn. Mineral. *and* Boyle *Hiſtory of Mineral Waters.*

but conſiſting beſides of many hot and fiery Corpuſcles, promotes the Inflammation of thoſe Wounds which the Cryſtalline *Spicula* make in the Membranes of the Stomach.

Upon the Score of ſuch a Texture and Make as this, *Arſenick* makes no Ebullition either with *Alcalies* or *Acids* (*a*); and *as* the *Regulus* of It being cleared from moſt of its Salts, is by much leſs hurtful than the crude Mineral it ſelf; *ſo* on the other Hand, the *Factitious White*, in which there is a much greater Proportion of the Saline to the Metallic Parts, is the moſt Violent of all the kinds, ſuperiour in Force to *Mercury Sublimate.*

The ſeveral Hiſtories related by *Wepfer* (*b*) do put this out of Queſtion; It is ſufficient to our Purpoſe to mention One.

A Dog having eat ſome Fat mixt with *White Arſenic*, died the next Day; The upper Part of the Stomach, when opened, was red and inflamed, the Coats thinner than ordinary, the bottom of It was covered with a fætid Slime, and ſome Pieces of Fat; The Thin Guts were ſo

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(*a*) Grew *of Mixture*, pag. m. 246.
(*b*) Cicut. aquat. *pag.* 274. & ſeq.

Corroded as to be Pervious in Three Places, Two of the Ulcers ſo large that they would eaſily admit a *Bean.* The Cavity of the *Abdomen* contain'd a yellowiſh *Ichor* tinged with Blood.

The Caſe being thus, one would wonder what ſhould induce Authors to preſcribe ſo Corroſive a Mineral to be worn upon the *Pit* of the Stomach, as an *Amulet* againſt the Plague. This Trick we may well believe to be Dangerous, when *Lionardo di Capoa* (*c*) tells Us of a Child kill'd by the Violent Vomiting and Purging, occaſioned from a ſlight Wound made in the Head by a *Comb* wet with Oil in which *Arſenick* had bin infuſed; for the Pores of the Body being opened by Heat and Exerciſe, ſome of the Noxious *Effluvia* may eaſily Inſinuate themſelves into the Part; accordingly *Crato* (*d*) obſerv'd an Ulcer of the Breaſt cauſed by this Application; *Verzaſcha* (*e*) Violent Pains, and fainting Fits; *Diemerbrock* (*f*), and Dr. *Hodges* (*g*), Death it ſelf.

(*c*) Incertezza de Medicament. *p. m.* 82.

(*d*) Epiſtol. 168.

(*e*) *Obſervation 66.*

(*f*) De Peſte, *Hiſtor.* 99.

(*g*) De Peſte Londinenſ. *p.* 239.

The truth of the Matter is, This Practice ſeems to owe its Origine to a Miſtake (*b*), ſome of the *Arabian* Phyſicians had commended *Darſini* worn in a Bag for a Preſervative in Plague time; This in their Language ſignifies *Cinnamom*; but the *Latin* Interpreters retaining the ſame word in their Tranſlations (as was frequently done), one or other afterwards not underſtanding its meaning, and deceived by the likeneſs of the ſound, ſubſtituted in its Place *De Arſenico*, as if *Darſini* were all one with *Zarnich*. The Authority of the firſt Author ſerved to propagate the Error; nor were Thoſe wanting who reaſon'd upon the Matter, and found it agreeable to their Philoſophy, that this Mineral ſhould draw to it ſelf and concenter the *Arſenical Effluvia* out of the Air, and thus ſecure the Body from their Infection; Theſe being, as they imagined, the Common Cauſe of Peſtilentia Diſeaſes.

Having thus particularly Diſcourſed o the Nature of theſe Two Poiſons, I ſhall not need to inſiſt upon any more out of the *Mineral Kingdom.*

(*b*) A. Deuſingius de Peſte, *Part* 4. *Sect.* 3. *c.* 3.

All of *Them* bear ſome Analogy to the former, and are more or leſs Dangerous, according as their *Salts* receive a differing Force from the *Metallic* Particles. For this Reaſon as we have obſerved, that the moſt Virulent may be mitigated by breaking the *Points* of the *Saline Cryſtals*; ſo on the other Hand, the moſt Innocent Minerals may become Corroſive by combining Them with *Salts*, as we ſee in the ſeveral Preparations of *Silver*, *Antimony*, *Iron*, &c.

Poiſonous Plants.

TO Proceed therefore to *Vegetables*; the moſt Notorious of *Theſe* for Venomous Juices among the Ancients were *Cicuta* and *Aconitum*.

Our *Oenanthe Cicutæ facie*, *ſucco viroſo*, which *Wepfer* has deſcribed by the Name of *Cicuta Aquatica*, and of the diſmal Effects of which in ſome Children who by miſtake did Eat of It, He has wrote a large Volume, was very probably the

Cicuta ſo much in uſe of old, eſpecially at *Athens*, for *Killing*. At leaſt the Violence of *This* makes It a much fitter Inſtrument of Death than the common *Hemlock*, which is not by far of ſo Malignant a quality.

Tho' we muſt withal allow differing *Climates* very conſiderably to heighten or abate the *Virtues* of *Plants*. And it is not altogether Improbable, that the Poiſon with which the *Athenians* took away the Lives of Malefactors was an inſpiſſated Juice, compounded of *That* of *Cicuta* and other Corroſive Herbs (*i*).

But be this as it will; The alterations which *Wepfer* obſerved the Roots of *Oenanthe* to make in the Body, were, a Violent Pain and Heat in the Stomach, Terrible Convulſions, with the loſs of all the Senſes, Diſtorſion of the Eyes, and flowing of Blood out at the Ears, The Mouth ſo faſt ſhut that no Art could open It, Efforts to Vomit, but nothing thrown up, frequent Hick-Coughs, with a great Diſtenſion and Swelling, eſpecially at the Pit of the Stomach; and when Death had concluded the Tragedy, a continued Running of Green Froth at the Mouth.

(*i*) Vide *Wepfer*, Pag. 60.

Stalpart van der Wiel gives Us the like account of Two Perſons killed at the *Hague* by the ſame *Roots* (k).

In a *Dog*, who for Experiment's ſake died by this *Poiſon*, The Stomach when opened was found quite *Conſtringed*, and Shut up at both *Orifices*, Its inward Surface red, with livid Spots here and there; The Inteſtines were empty; only the *Rectum* contained a little greeniſh *Mucus*.

Thus it appears, that this Plant conſiſts of Hot, Acrious and Corroſive Parts, which by Rarefying the Juices of the Stomach, and Wounding Its Nervous Membrane, are the Cauſe of all thoſe Diſorders which do immediately follow.

For upon the Senſe of a violent *Irritation* and *Pain*, the Fluid of the Nerves is preſently in large quantities determined to the Part affected; and this, if the *Stimulus* be not over great, will be only to ſuch a Degree as is ſufficient, by contracting the Fibres of the Stomach, and Muſcles of the *Abdomen*, to throw off the Cauſe of the Diſagreeable *Senſation*; but the uneaſie *Twitching* being too terrible to be borne, the Mind, by a kind of ſurpriſe, does with *Haſte* and *Fury* as it were Command the Spirits thither; Thus the Buſineſs is over done, and the Action of the Fibres becomes ſo ſtrong, that the Orifices of the Stomach are quite cloſed; ſo that inſtead of diſcharging the Noxious Matter, The *Torment* is made greater, and the whole *Oeconomy* put into Confuſion.

(k) Obſervat. Centur. 1. *Obſ.* 43.

This forcible Contraction of the Muſcles was the Reaſon that one of the Children which *Wepfer* ſaw, made *Urine* in the midſt of the Agony, to the heigth of Five or Six Foot, with a ſtrength and violence Surpriſing to the Spectators.

Nor is it any wonder, if in theſe *Circumſtances* all Senſe be loſt, Blood guſh out at the *Ears*, *Noſtrils*, &c. the Parts being all torn and broke by the Violence of the *Convulſions*; which tho' they began in the Muſcles of the Belly, muſt at laſt prevail in the Members too, till the whole Fabrick is ſhock'd and overturned: and ſome of the *Corroſive Salts* perhaps getting into the Blood, and by the Rarefaction of It Diſtending the Veſſels, The Membranous Coats of which being already overſtretched, will the more eaſily give way, and let out their Fluid.

The Caſe of *Aconitum* is much the ſame; this is our *Napellus* or *Monks-hood*; and its Effects do ſo nearly agree with thoſe now related of *Oenanthe*, that I ſhall not need to recite Them; the Experiments of *Wepfer* (*a*) are full and convincing. And indeed *as* all the *Hiſtories* which this ſame *Author* has ſo carefully given Us of Trials made with ſeveral Vegetable Poiſons, *Solanum*, *Nux Vomica*, *Cocculus Indicus*,&c. on different Creatures, do put it out of all doubt, that the common Miſchief of *Theſe* is a Twitching and Inflammation of the Stomach; *ſo* it appears from hence, that *Virulent Plants*, altho' they may be diſtinguiſhed even from one another by *particular Virtues*, do however *Kill* by a like Operation and Force, which differs chiefly in Degree from *That* of Noxious Minerals.

And therefore in order to know what the *Specifick Qualities* of any ſuch *Herbs* are, they muſt be given only in very ſmall *Doſes*; and then perhaps it would appear, that they are not made (as ſome do imagine) to be deleterious and de-

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(*a*) *Pag.* 176. ſeq.

ſtructive, but for very Good and Beneficial Uſes; as we do particularly Experience in the Caſe of *Opium.*

Nor is it at all ſtrange, that the *Symptoms* from a *Vegetable*, and from a *Mineral* Virulency, ſhould be ſo different, altho' of the ſame kind, and only of unequal force; for the more ſolid Parts of *Minerals*, eroding the Coats of the Stomach, induce a perfect Mortification and Gangrene, and thus do their Work at once; whereas the weaker Salts of *Plants* can make but a ſlighter *Excoriation*, upon the painful Senſe of which thoſe Agonies and Convulſions that follow do rather gradually exhauſt the Strength; and thus the Animal is not kill'd ſo ſpeedily, nor with the ſame *Appearances.*

Upon this Score, tho' Mineral Poiſons do not paſs the *Primæ Viæ*, Vegetable ones in ſome Caſes poſſibly may; juſt as We find Thoſe Medicines which have a great Degree of Irritation preſently to induce a *Vomiting*; whereas the ſame *Twitching* a little weakened ſuffers them to paſs into the Inteſtins, and *Work* downwards by Stools.

By this We may perhaps give ſome Gueſs at the Nature of thoſe *Poiſons*, with which They tell Us the *Natives* in ſome Parts of *Africa* and *India* are ſo expert at Killing, that they can do It in a longer or ſhorter time as they pleaſe. Theſe are moſt probably either the *Fruits*, or the Inſpiſſated *Juices* of Corroſive Plants, which inflaming the Bowels, may cauſe little Ulcers there, whoſe Fatal Conſequences, we know, may very well be ſlow and lingering.

This I am the rather induced to believe, becauſe an Ingenious *Surgeon*, who liv'd in *Guinea*, told Me, that the *Antidote* by which the *Negroes* would ſometimes Cure Thoſe who were *poiſoned*, was the *Leaf* of an *Herb* which purged both upwards and downwards. For by this means the Stomach might be cleared from the adhering Corroſive Parts of the Venom. Yet I can hardly think it poſſible at the ſame time that they ſhould be able, by varying the Compoſition or Quantity of the *Doſe*, to aſcertain the Time in which It ſhall Kill, to a Week, Month, *&c.* nor indeed have I ever met with any Perſon who could Atteſt This to be Matter of Fact.

Tho' repeated Trials and Obſervations may help one well practiſed in ſuch Tricks to give notable Conjectures in this Point.

The Ancients indeed pretended much the ſame thing with their *Aconitum*, of which They ſeem to have made a kind of Secret and Myſtery; as we learn from *Theophraſtus* (*a*), who ſays, *The ordering of this Poiſon was different, according as It was deſigned to Kill in Two, Three Months, or a Year:* But this he relates only as a common *Tale* or *Opinion*, and not as a Story to which Himſelf gave any manner of Credit.

It is very plain, that the common *Cure* of all *Poiſons* of this kind, muſt be by freeing the Stomach as ſoon as poſſible from the Corroſive Vellicating Particles, and defending the Membranes from their Acrimony, by ſuch Things as are of a Smooth, Oily and Lubricating Subſtance.

(*a*) Hiſt. Plant. *l.* 9. c. 16.

Eſſay the Fourth.

OF

OPIUM.

THE Ancients having Experienced that *Opium* would oftentimes Kill, tho' taken in no large quantity, ranked It with *Poiſons*, and gave It the firſt place among Thoſe, which from their Stupefying Quality They call'd *Narcotic*.

True indeed it is that We do every Day find This to be, in a ſmall Doſe, one of the moſt Noble Remedies in the World. But it is not worth the while to engage in the Controverſie warmly debated by ſome *Authors*, how far *Poiſons* are

Medicinal; ſince it is notorious enough
that Medicines do ſometimes prove *Poi*
ſonous. And take the Matter as W
pleaſe, it may ſerve to very good Pur
poſes to underſtand the manner of Ope
ration of ſo Celebrated a *Drug*, and hel
Us in a great Meaſure to aſcertain Its Uſ
in different Caſes, if we are beforehan
rightly appriſed of Its Nature and Wa
of Acting.

In order hereunto, it is neceſſary, be
ſides ſome other *Præcognita*, ſince one c
the chief Virtues of this Medicine
Hypnotic, to Define diſtinctly what *Slee*
is, or rather, (to avoid Confuſion an
Diſputes about Words) what differen
there is between an Animal Body whe
aſleep and when *awake*. For I ſuppo
the *Hiſtory*, *Manner of Preparing*, &c. o
Opium to be already ſufficiently known.

Firſt then, There is no One but know
that in *Sleep* there is a Ceſſation fro
Action. When *Waking* We Walk, Di
courſe, Move this or that Limb, *&c.* b
in natural and undiſturbed *Reſt* there
nothing of all Theſe; that is, where
being awake, We do perform ſeveral M
tions by the *voluntary* Contraction of o
Muſcles; when aſleep, thoſe Muſcles o
ly are Contracted whoſe Action is in

mann

manner *Involuntary*, or to which the Mind has always ſo conſtantly determin'd the Spirits, that It does it by a *Habit*, without the Intervention of the Reaſoning Faculty; ſuch are *Thoſe* of the Heart and Breaſt.

So that there is at this time a kind of *Relaxation* or Looſneſs of the moving Fibres of the ſeveral Members; or at leaſt ſuch a quiet Poſition and State of them, by which all the *Antagoniſt* Muſcles are in an *Æquilibrium* and Equality of Action, not overpowering one another. For this indeed ſeems to be one great Deſign of Sleep, to recover to the Parts overſtretched by Labour their former *Tone* and Force; and therefore we do naturally, when compoſing our ſelves to *Reſt*, put our Body into that Poſture which does moſt Favour the *particularly* wearied Limbs, and conduce to this end.

In the next place, it is very plain that there is in *Sleep* not only a Reſt and Suſpenſion from Acting of moſt of our Bodily Organs, but even of our *Thinking Faculty* too. That is (for I would prevent Cavils) a ceaſing from ſuch *Thoughts* as when Waking We are exerciſed about, which we do *Reflect* upon, and *Will* to employ our Mind with. For tho' *Dreams*

are

are Thoughts, yet they are but imperfect and incoherent Ones, and are indee either ſo faint and languid *Repreſentations* as to be conſiſtent with our *Sleep*, as ſom may be; or elſe if they be ſtrong an lively, they are, as every one knows, th *Interruption* and Diſturbance of It.

From hence It will follow, that th *Motion* of the Arterial Fluid muſt be, *Ce teris Paribus*, more ſedate, even and re gular, in the time of *Sleeping* than *Waking* For, beſides the various Alterations whic in the latter State this receives from th ſeveral *Paſſions* of the Mind, the ver *Contractions* of the Muſcles themſelves i Exerciſes of the Body do differently fo ward its Courſe; whereas in *Sleep* th force of the Heart and Pectoral Muſcl being more conſtant and uniform, giv it a more calm and equally continue Impulſe.

Hence alſo it will come to paſs, th the *Influx* of the *Liquor* of the Nerves i to the Organs of the Body, as alſo I *Reflux* towards the *Brain*, is in Sleep e ther none, or very inconſiderable; that that this Fluid has at this time but lit or no *Motion*. For 'tis Muſcular *Acti* and *Senſation* that require It to be th determin'd, this way or that, which a now hardly any. And yet by the arrival of the Blood at the Brain, this *Juice* will ſtill be ſeparated there, fit to be derived into its Canals or Tubes. So that by this means there will be a kind of *Accumulation*, or laying up in Store, of *Spirits* for the Offices and Requirements of *Waking*.

Thus We may in ſhort look upon the time of *Watching*, as the time of Wearing out, or the Deſtruction of the Animal Fabrick; and the time of *Sleep*, as that in which it is repaired and recruited; not only upon the account of what We have juſt mentioned concerning the *Nervous Liquor*, but alſo with reſpect to all the other Parts, as well Fluid as Solid. For *Action* does neceſſarily by Degrees impair the Springs and Organs; and in *Motion* ſomething is continually abraded and ſtruck off from the Diſtractile Fibres, which cannot otherwiſe be reſtored than by their being at reſt from *Tenſion*. Beſides that, ſuch a regular and ſteady *Courſe* of the Blood, as we have obſerved to be in *Sleep*, is by far more fit and proper for Nutrition, or an Appoſition of Parts to the Veſſels, which an uneven *Hurry* of It is more apt to tear off and waſh away.

The Caſe being thus, it is very plain, that whatſoever can induce ſuch a Diſpoſition of the Fluids and Muſcular Parts of the Body, as this We have deſcribed, will ſo far cauſe *Sleepineſs.* And in like manner, when any thing interpoſes and hinders this Compoſedneſs and Tranquillity, the removing of the *Impediment* will be the cauſing of *Sleep*; inaſmuch as this is only reducing the Animal *Oeconomy* to its right State, in which by natural Order there muſt be a Succeſſion of Sleeping and Waking.

Thus it appears how neceſſarily continued Exerciſes do make Us *Sleepy*, ſince Theſe do exhauſt the Juice of the Nerves; that is, both leſſen its Influx into the Organs of Motion, and incline the Mind not to determine it any longer that way, upon the account of the Pain and Uneaſineſs, with which too violent a Tenſion of the Parts is always attended; which therefore we muſt needs deſire to Relax, or lay to *Reſt.*

That *Sleepineſs* which follows upon a fulneſs of the Stomach after Eating or Drinking, is owing to a different Cauſe; and does indeed ſo nearly fall in with the Effects of *Opiate* Medicines, that it requires a particular Conſideration.

As *Hunger*, or the Emptineſs of the Stomach, is a painful Senſation ; ſo the ſatisfying or removing of *This*, is a pleaſing or agreeable One. Now all *Pain* is a *Stimulus* upon the Part affected ; and This, we all know, being attended with Contractions of the pained Membranes, cauſes a greater Afflux than ordinary of the Nervous Juice that way. On the other Hand, *Pleaſure*, or a delightful Senſation in any part, is accompanied with a ſmooth Undulation, and eaſie Reflux of the Liquor of the Nerves towards the Brain. This is as it were the *Entertainment* of the Mind with which being *Taken up*, it does not Determine the Spirits to the Organs of Motion ; That is, there is ſuch a *Relaxation* of the Muſcular Fibres, and ſuch a Diſpoſition of the Nervous Fluid, as we have obſerved to be neceſſary to Sleep.

This is the Reaſon of that *Chillineſs* in the Limbs, which we commonly Complain of after a good Feaſt.

If it ſeem ſtrange that a Pleaſure in the Stomach ſhould ſo powerfully Influence the Mind ; Let it be conſidered, on the other Hand, how violent Effects, an uneaſie and diſagreeable Senſe in the ſame Part does produce ; what a terrible Agony Two or Three Grains of *Crocus Metallorum* throws the whole Fabrick into; how readily the Fluid of the Nerves is with a more than Ordinary *Impetus* determin'd and commanded into the Muſcles of the Stomach and *Abdomen*, in order to throw off the Enemy, and remove the ungrateful Senſation.

Now the Conſequences which we have aſcribed to a pleaſing Senſe in this Part, are only juſt the contrary of theſe we find the oppoſite Affection of Pain induces. And indeed *Pleaſure* and *Pain* are Two great Springs of Action in the Animal Oeconomy; The Changes they make in the Fabrick are the Cauſes of many Effects which ſeem ſurpriſing, becauſe we do not regard the Mechaniſm by which they are produced: But theſe muſt be more conſiderable in the Stomach than any where elſe; This Part being, for very wiſe Purpoſes, of ſo acute a *Feeling*, that ſome Philoſophers have for this Reaſon thought It to be the Seat of the Soul.

Beſides this Conſideration, We muſt take notice that, the Stomach being diſtended with Food, preſſes upon the deſcending *Trunk* of the *Aorta*, and thus cauſes a greater Fulneſs of the Veſſels in the upper Parts; whereupon the Brain is loaded, or the Derivation of Spirits into the Nerves diminiſhed, and *Unactivity* or *Drowſineſs* inſues. From hence proceed Thoſe *Fluſhings* in the Face, Redneſs, *&c.* after plentiful Eating or Drinking, moſt Viſible in Thoſe whoſe Veſſels are Lax and Weak, as in Exhauſted and Hectick Perſons they more eſpecially are.

Thus we may, without the Aſſiſtance of the *New Chyle* entring into the Veſſels, account for that Inclination to Sleep which follows upon a full Stomach; Tho' we muſt alſo allow the Diſtention from *This* to be a conſiderable Cauſe of the ſame Effect; But this does not happen immediately, nay, ſometimes perhaps not within Two or Three Hours after Eating; and therefore the ſudden *Drowſineſs* muſt (as well as the preſent Refreſhment and Reviving which Meat gives) be chiefly owing to ſome more ſpeedy Alteration.

We come then in the next Place to *Opium* it ſelf; The Chymical *Analyſis* of which (*a*) does out of One Pound afford of a Volatile *Spirit* of the like Nature with that drawn from Harts-horn, Five Oun-

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(*a*) Vid. Pitcarn. de Circulatione Sanguinis in animalibus, §. 20, ces and Five Drachms; of a fætid *Oil*, One Ounce Two Drachms and a half; of *Caput Mortuum*, ſmelling like Spirit of Harts-horn, Seven Ounces and Six Drachms.

The Virtues therefore of *Opium* are owing to a volatile *Alcaline* Salt, intimately mixt and combin'd with an Oily, Sulphureous Subſtance. The Effects of which We muſt conſider, firſt of all upon the Stomach, and afterwards, when they have paſſed the *Primæ Viæ*, upon the Arterial Fluid it ſelf.

An agreeable Senſation produced in the Stomach, together with a Diſtenſion of Its Membranes, we obſerved before to be the Cauſe of that Sleepineſs to which we are ſo prone after Eating. The *One* of Theſe ingages the Mind, the *Other* acts upon the Body. For Pleaſure amuſes the Soul, as it were, ſo that It does not Think, or exerciſe it ſelf about any outward Objects; that is, Is inclined to Reſt. And the Fulneſs of the Veſſels in the Brain Checks and Hinders, in ſome Meaſure, the Derivation of the Nervous Juice into the Organs, *&c.*

Now They who take a moderate Doſe of *Opium*, eſpecially if not long accuſtomed to It, are ſo Tranſported with the pleaſing Senſe It induces, that They are, as They oftentimes expreſs themſelves, in Heaven; and tho' They do not always Sleep, (which proceeds from the Preſentation of pleaſing Images to the Mind being ſo ſtrong, that like Dreams they do over-ingage the Fancy, and ſo interrupt the State of Reſt) yet they do however injoy ſo perfect an Indolence and Quiet, that no Happineſs in the World can ſurpaſs the Charms of this agreeable Extaſie.

Thus We have from this Medicine, but in a far more eminent Degree, all thoſe Effects which we obſerved to follow upon that grateful Senſe in the Stomach which a moderate Fulneſs produces. For no Bodies are ſo fit and able pleaſingly to affect our ſenſile Membranes, as Thoſe which conſiſt of Volatile Parts, whoſe activity is tempered and allayed by the ſmoothneſs of ſome Lubricating and Oily ones; which by lightly Rareſying the Juices of the Stomach, and cauſing a pleaſant Titillation of Its Nervous Coat, will induce an agreable *Plenitude*, and entertain the Mind with Ideas of Satiſfaction and Delight.

The Caſe being thus, We eaſily ſee upon what Mechaniſm the other Virtues of *Opium* do depend, Its Eaſing Pains, Checking Evacuations, *&c.* not only in that the Mind being taken up with a pleaſing Senſe, is diverted from a diſagreeable *One*; But all Pain being attended with a Contraction of the Part, That Relaxation of the Fibres which is now cauſed, eludes and deſtroys the Force of the *Stimulus*.

In like manner in immoderate Secretions there is moſt commonly an Irritation of the Organs, the Removal of which will abate the Diſcharge. And herein lyes the *Incraſſating* Quality of this Medicine, in that the Twitching Senſe upon the Membranes of the Lungs, Bowels, *&c.* being now leſſened, the ſharp Humor is ſuffered to lodge there in a greater quantity before it is ſo troubleſom as to be thrown off and expell'd; it being all one as if there were no Irritation of the Part, if the uneaſie Senſe thereof be not regarded by the Mind.

Theſe Effects will all be heightened by the Mixture of the *Opiate* Particles with the *Blood*; Which is hereupon Rarefied, and Diſtends its Veſſels, eſpecially thoſe of the Brain; and thus does ſtill to a greater Degree leſſen the Influx of the Nervous Fluid to the Parts, by preſſing upon the little *Tubuli*, or Canals, thro' which it is derived.

This is the Reaſon of that *Difficulty of Breathing*, which They do for a time Experience who take theſe kind of Medicines; This Symptom being inſeparable from the Rarefaction of the Blood in the Lungs.

From hence it appears, that the action of *Opium* is very Analogous to that of other Volatile Spirits, only that a ſmall Portion of It has a force equal to that of a greater quantity of moſt of Them.

This is very evident in Thoſe who accuſtom Themſelves to take large Doſes of It; as the *Turks* and *Perſians* do to that Degree, that it is no uncommon thing there to Eat a Drachm or Two at a time; for the Effects of It in Them are no other than downright *Drunkenneſs*; upon which account (*b*) it is as common a ſaying with Them, and on the ſame Occaſion, *He has eat Opium*; as with Us, *He has drank too much Wine.*

Neither indeed do They otherwiſe bear ſuch large quantities of It, than our *Tip-*

(*b*) Vid. Belon. Voyag. *lib.* 3. *c.* 15.

plers will a great deal of *Brandy*; that is, by habituating themſelves to It by degrees, beginning with ſmall Doſes, and requiring ſtill more and more to raiſe themſelves to the ſame *Pitch*. Juſt as *Galen* (*c*) tells Us of a Woman at *Athens*, who by a gradual Uſe had brought her ſelf to Take, without any hurt, a conſiderable quantity of *Cicuta* or Hemlock. Which Inſtance is the more to our Purpoſe, becauſe *Nic. Fontanus* (*d*) knew one who being Recovered of the Plague, and wanting Sleep, did, with very good Effect, eat *Hemlock* for ſome time, till falling Ill again of a Fever, and having left off the Uſe of this Remedy, He indeavoured to procure Reſt by repeated Doſes of *Opium*, which (Nature having bin accuſtomed to a ſtronger Alterative) had no Operation, till the help of *Cicuta* was again call'd in with deſired Succeſs.

It is a ſufficient Confirmation of all this Reaſoning, that *Proſper Alpinus* (*e*) obſerved among the *Egyptians*, thoſe who had bin accuſtom'd to *Opium*, and were faint and languid thro' want of It, (as Drinkers are if they have not their

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(*c*) Simpl. Medicam. Facult. *l.* 3. *c.* 18.
(*d*) Reſponſ. & Curat. Medic. *p.* 162.
(*e*) Medicin. Ægypt. *l.* 4. *c.* 1.

Spirits) to be recovered, and put into the ſame State of Indolence and Pleaſure, by large Doſes of *Cretic Wine* made hotter by the Infuſion of *Pepper*, and the like ſtrong *Aromaticks*.

Nor is it perhaps amiſs to remark, that in *Maniacal* People, as is frequently obſerv'd, a Quadruple Doſe of *Opium* will ſcarce produce any conſiderable Effect: Now in Perſons ſo affected, the Mind is deeply ingaged and taken up with ſome *Images* or other, as Love, Anger, *&c.* ſo that it is not to be ſo eaſily moved or diverted by thoſe pleaſing Repreſentations which it would attend to at another time, and upon which the Virtues of this Medicine do in a great meaſure depend. Beſides this, thoſe who are *Maniacal* do to a Wonder bear the Injuries of Cold, Hunger, *&c.* and have a prodigious degree of Muſcular Force, which argues the Texture of their *Blood* to be very ſtrong, and the Cohæſion of its *Globules* great; ſo that the Spiritous Parts of the *Opiate* cannot make that Disjunction and Rarefaction of this Fluid in Them, which it does in ordinary Bodies and Conſtitutions.

Many are the Improvements which might be made of this Theory, with relation to the Practice of Phyſick ; but theſe will be obvious enough to one inſtructed in the Animal *Oeconomy*.

To conclude then as to the Subject in Hand, it is very plain that there needs no more to make *Opium* prove Deſtructive or a *Poiſon*, than to take too great a quantity of It ; for then It muſt Inflame the Stomach, and Rarefie the Blood to ſuch a Degree, that the Veſſels cannot again recover their Tone, whereupon Apoplectic Symptoms, *&c.* will inſue.

To be convinced of this, I forced into the Stomach of a ſmall Dog about half a Drachm of Crude *Opium* diſſolved in Boiling Water. He quickly Vomited It up with a great quantity of Frothy Spittle ; but repeating the Trial, by holding up his Head, and beating him, I made him retain Three or Four Doſes, intermitting between each about a quarter of an Hour ; when he had thus taken, as I could gueſs, near Two Drachms, I watch'd him about an Hour, then he began to Sleep, but preſently ſtarted up with Convulſions, fell into univerſal Tremblings, his Head conſtantly twitch'd and ſhaking , he breath'd ſhort and with labour, loſt intirely the Uſe firſt of his hinder Legs, and then of the fore ones, which were ſtiff and rigid like Sticks. As he lay Snorting, to haſten his End, I was giving him more of the Solution, but on a ſudden his Limbs grew limber, and He Died.

Opening his *Stomach*, I found It wonderfully diſtended, tho' empty of every thing but ſome Water and *Opium*; parcels of Frothy *Mucus* ſwimming in It; the inſide was as clean as if ſcraped and waſhed from all the Slime of the Glands, with ſome Redneſs here and there, as in a beginning Inflammation. The *Pilorus* was Contracted. The Blood-Veſſels of the Brain were very full; and I took out a large Grume of Concrete Blood from the upper part of It, cutting into the *Sinus Longitudinalis*, as is not uncommon in Apoplectic Carcaſſes; but found no extravaſated *Serum* in the *Ventricles*, nor among any of the Membranes.

As to the Cure of ſuch a Caſe; beſides other Evacuations, Acid Medicines and Lixivial Salts muſt certainly do Service; theſe by their *Diuretic* force cauſing a Depletion of the Veſſels. This is the Foundation upon which *Starky* compounded his *Pacific Pill.* Generous *Wine* which the Ancients gave for an Antidote, can be no other ways uſeful than as It diſſolves the *Reſinous* Clammy

Part of the *Opium* ſticking to the Coats of the Stomach, and ſo forwards its Expulſion by other Helps, which cauſe a Contraction of the Muſcular Fibres.

Eſſay the Fifth.

OF
Venomous Exhalations
FROM THE
EARTH,
Poiſonous Airs and Waters.

BEſides theſe already treated of, there is yet another way of being *Poiſoned*, and that is by *Venomous Steams and Exhalations*, or a *Poiſonous Air* taken into the Body by the Breath.

This is notorious enough, and Authors do upon many Occaſions make mention of it; but when they come to explain the particular manner how this Kills, they moſt commonly reduce it to ſome of the *Poiſons* which prove deſtructive by being admitted into the Stomach, alledging that Malignant Fumes and Airs are therefore fatal, becauſe impregnated with *Arſenical*, *Mercurial*, and the like Deleterious Μιάσματα or Particles, they do convey theſe into the Blood; which being of a very Corroſive Nature, muſt neceſſarily do hurt both to the Fluid and Solid Parts.

And indeed that the *Fumes* of theſe ſame Minerals are very pernicious, and Air fill'd with their Atoms very unfit for Reſpiration, is moſt certain; but to argue from hence, that all deadly *Vapours* and Malignant *Airs* owe their Miſchief to theſe only, is too fond and ill-grounded a Conceit; ſince upon a due Enquiry it will appear, that there may be, and are, *Mortiferous Exhalations* from the Earth, infecting the Air, of a Nature ſo different from any of thoſe *Poiſons*, that the very Subſtance from which they ariſe may not be at all hurtful, tho' taken into the Stomach it ſelf.

Venomous Steams and Damps from the Earth the *Latins* in one Word call'd *Mephites* (*a*).

This, as many other *Tuſcan* Words, comes from a *Syriac* Theme, which ſignifies to blow or breathe (*b*).

And in ancient times ſeveral Places were notorious for 'em; ſo the *Mephitis* of *Hierapolis* was very Famous, of which *Cicero*, *Galen*, but more particularly, and from his own Sight and Knowledge *Strabo* (*c*) makes mention.

Such another was the *Specus Corycius* in *Cilicia*, which upon the account of its ſtinking deadly Air, ſuch as is thought to proceed from the Mouth of *Dragons*, which the Poets give to *Typhon*, was call'd *Cubile Typhonis*. This *Pompon. Mela* (*d*) deſcribes; and it is indeed as ancient as *Homer* (*e*); for *Arima*, in which he places it, was, as *Didimus* ſays, a Mountain of *Cilicia*.

(*a*) Virgil *Æn.* 7. *v.* 84.
—— Sævamq; exhalat. opaca Mephitim.
Vid. Servium, ibid.

(*b*) Scaliger. Conject. in Varron.

(*c*) *Lib.* 13.

(*d*) De Situ Orb. *l.* 1. *c.* 13.

(*e*) 'Ειν 'Αρίμοις ὅθι φασὶ Τυφώεος ἔμμεναι εὐνάς. Il. β. *v.* 783.

Neither are ſuch *Fumes* as theſe infrequent Now-a-days; and tho' moſtly taken notice of in Mines, Pits, and other Subterraneous Places, yet they are ſometimes met with in the Surface of the Earth too, eſpecially in Countries fruitful of Minerals, or pregnant with Imbowelled Fires; ſuch are *Hungary* and *Italy*, which latter (as *Seneca* (*f*) obſerves) has always bin more than any other remarkable for 'em.

I ſhall therefore, having had the opportunity of making ſome Remarks upon One the moſt Famous of all in thoſe Parts, give as good an account as I can of *That*, and its manner of Killing; which tho' I dare not affirm to be univerſally applicable to any *Mephitis* whatſoever, yet ſeems plainly to be the Caſe of moſt of 'em; and where it is not, this ſimple Miſchief will only be found to be complicated with another; and then ſome extraordinary Symptoms or Appearances in the Animals kill'd, will eaſily make a Diſcovery of the Additional Venom and Malignity.

This Celebrated *Mofeta*, taken notice of, (or at leaſt ſome other hereabouts)

(*f*) Nat. Quæſt. *l.* 6. *c.* 28.

even in the time of *Pliny* (*g*), is about Two Miles diſtant from *Naples*, juſt by the *Lago d' Agnano*, in the way to *Pozzoli* or *Puteoli*, and is commonly call'd *la Grotta de' Cani*, becauſe the Experiment of its deadly Nature is frequently made upon *Dogs*; tho' it be as certainly fatal to any other Animal, if it come within the reach of its Vapour; for *Charles the Eigth of* France proved it ſo upon an *Aſs*; and two *Slaves* put into it by order of *D. Pietro di Toledo* Viceroy of *Naples*, with their Heads held down to the Earth, were both killed (*h*).

'Tis a ſmall *Grotta* at the Foot of a little Hill, about Eight Foot high, Twelve long, and Six broad; from the Ground ariſes a thin, ſubtle, warm *Fume*, viſible enough to a diſcerning Eye, which does not ſpring up in little parcels here and there, but is one continued Steam, covering the whole Surface of the bottom of the Cave; and has this remarkable difference from common Vapours, that it does not, like Smoak, diſperſe it ſelf into the Air, but quickly after its riſe falls back again, and returns to the Earth; the

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(*g*) Nat. Hiſt. *l.* 2. *c.* 93.
(*h*) L. di Capoa delle Moſet. *pag.* 37.

Colour of the ſides of the *Grotta* being the meaſure of its Aſcent; for ſo far it is of a darkiſh Green, but higher, only common Earth, and this is about Ten Inches. And therefore as my ſelf found no Inconvenience by ſtanding in it, ſo no Animal of its Head be kept above this Mark is in the leaſt injured: But when (as the manner is) a Dog, or any other Creature, is forcibly held below it, or by reaſon of its ſmalneſs can't hold its Head above it, It preſently, like one ſtunn'd, looſes all Motion, falls down as Dead, or in a Swoon, the Limbs convulſ'd and trembling, till at laſt no more ſign of Life appears than a very weak and almoſt Inſenſible beating of the Heart and Arteries, which if the Animal be left there a little longer, quickly ceaſes too, and then the Caſe is Irrecoverable; But if ſnatch'd out, and laid in the open Air, ſoon comes to Life again, and ſooner if thrown into the adjacent *Lake*.

In this ſhort, but accurate, Hiſtory of the *Grotta de' Cani*, I have ſet down thoſe Particulars which do not only diſtinguiſh *Mephitical* Exhalations from common and innocent Fumes, but alſo give hints ſufficient, I think, Mechanically to determine the Reaſon and Manner of their ſurpriſing Effects.

And not to ſpend time in refuting the Opinions of Others, I ſhall only take Notice, that here can be no ſuſpicion of any true *Venom* or real Poiſon; if there was, it were impoſſible that Animals taken out of the *Grotta*, ſhould ſo immediately recover the Effects of it, without any remaining appearance of Faintneſs and Sickneſs, or ſuch like Symptoms as thoſe ſuffer who have bin breathing in an Air impregnated with malignant corroſive *Effluvia*. Beſides, that the Venomous Corpuſcles would certainly, in ſome Degree at leaſt, infect the Air in the upper Part of the Cave, which continues pure, and fit for Reſpiration. Neither indeed after what manner ſoever this Poiſon be imagined to Act, whether by diſſolving or coagulating the Blood, could its Efficacy be ſo ſudden and momentaneous, without ſome Marks of it in the Creatures killed, when opened, which yet do diſcover nothing of this Nature extraordinary, neither in the Fluid, nor in the Solid Parts.

In order therefore to underſtand wherein this deadly quality Conſiſts; I ſay in the firſt Place, that Life, ſo far as it reſpects the Body, is, in one Word, the *Circulation* of the Blood; that is, its motion in *Conical* Diſtractile Veſſels from the Heart to the Extreme Parts, and its Return to the Heart again by the ſame Canals inverted; For, 'tis upon this that all Animal Functions, all Senſe and Motion, Voluntary and Involuntary, do depend; ſo that the regularity of this Courſe is the Meaſure of Health, or the moſt perfect Life, as its various Irregularities are the Occaſions of Sickneſs and Diſeaſes, or a beginning Death.

Now all the Animal Operations and Offices which proceed from this Circulation, are the Effects of ſeveral Secretions of Liquors of very different Natures out of the ſame Fluid Maſs; It was therefore abſolutely neceſſary that the Blood before It be diſtributed to the Organs ſhould be ſo comminuted and broken, as that no Cohæſion of is Parts ſhould hinder the Separation of theſe *Juices* from It, when it Arrives with a determinate Force at the Orifices of the Secretory Veſſels.

This Work is done in Its Paſſage thro' the *Lungs*, by the repeated Compreſſion of the Air in thoſe *Bladders* upon the Arteries, with wonderful Contrivance diſpers'd among 'em (*a*). Herein lyes the

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(*a*) Vid. Malpigh. de Pulmon.

Uſe and Neceſſity of *Reſpiration*; and the ſudden Miſchief of Stopping it, in that the whole Maſs of Blood being to paſs this way, upon a Check here, there preſently inſues a Stagnation, that is, a Ceſſation of all Animal Functions, or Death; Which will be the more ſpeedy, if not only no Air is inſpired, but a Fluid of a quite different Nature from It ſucceeds in its Place.

Wherefore it muſt be obſerved, that this good Effect of the Air is performed by its *Elaſticity*; And that no Fluid whatſoever, that we know, beſides is *Elaſtic*, at leaſt to any conſiderable Degree, that is, has a faculty of expanding and dilating it ſelf when compreſſed; No, not *Water*, as near as That is thought to approach to Air in its Nature.

And now as to the preſent Caſe, I took notice before that this *Vapour* is one continued and uninterrupted *Steam*, and that quickly after Its riſe it falls down again; that is, that it has little or no mixture of Air with It, or no Elaſticity; and is, on the other Hand, very heavy, when forſaken by the Force of *Heat* that drove it upwards.

So that I make no Queſtion, but that Animals in this Place do inſtead of Air inſpire *Mineral Fumes*, that is, a thin watery Vapour, impregnated with ſuch Particles as do, when united together, compoſe ſolid and heavy Maſſes; which is ſo far from helping the Courſe of the Blood thro' the *Lungs*, that it rather expels the Air out of the *Veſiculæ*, and ſtraitens the Paſſage of the Blood Veſſels, by its too great Gravity; whereupon the *Bladders* are relaxed and ſubſide, and the Circulation is immediately Interrupted. But if the Animal be in time removed out of this *Steam*, that ſmall Portion of Ai which does after every Exſpiration remain in the *Veſiculæ*, may be powerfu enough to drive out this Noxious Fluid eſpecially if the Head of the Creature b held downwards, that ſo its Gravity may forward its Expulſion; or It be thrown into Water, which by aſſiſting, upon th account of its Coldneſs, the Contraction of the Fibres, promotes the retarded Circle of the Blood; as we every Day experience in a *Deliquium Animi*, or Swooning Fit.

Tho' if this Stagnation be continued too long, no Art can renew Life, n more than in One perfectly ſtrangled; no will the *Lake of Agnano* it ſelf be of an Service; which ſhews that there is n ſingula ſingular Virtue in That Water beyond any other; nor is it, as ſome have fondly Imagined, a Peculiar Antidote to the Poiſon of the *Grotta*.

The bad Effects of ſuch *Fumes* as This will be the more certain, becauſe the inſpired Mineral Particles twitch and irritate the Membranes, which are hereupon contracted to that Degree, as not to be able to recover their Tone, and ſo the Force and Action of the *Lungs* is quite loſt.

It appears from all This not to be at all neceſſary to make any farther Enquiry into the Particular Nature of theſe Mineral Particles, ſince they do in this Caſe act chiefly by their *Gravity*, which is common to 'em all. Tho' indeed the *Greeniſh* Colour of the Earth, together with its *Subacid* Taſte, very much (as *L. di Capoa* obſerves) like to that of the *Phlegm* of *Vitriol*, ſeem to declare them, if not altogether, yet principally at leaſt, to be *Vitriolick*.

To conclude this Part of our Diſcourſe; I think it a ſufficient Confirmation of this Reaſoning, that in *Frogs* kill'd in this *Grotta*, the *Bladders* of the Lungs (more viſible otherwiſe and diſtinct in theſe Creatures perhaps than in any other) were found ſubſided, and quite empty of Air (*c*). But if any one deſires a farther Proof, he may, according to theſe Principles, make (as *Lionardo di Capoa* (*d*) did) an Artificial *Mephitis*; for if *Antimony*, *Biſmuth*, or any other ſuch Mineral be finely poudered, and moiſtened with *Aqua Fortis*, or *Spirit* of *Nitre*, there will ariſe a great Heat, and a thick dark Smoak, in which, as in the *Grotta de' Cani*, Torches are extinguiſh'd, and Animals, tho' but ſlowly, ſtifled and kill'd. And this Effect will be more ſenſible, and equal to the moſt Violent *Mephites*, if the *Antimony* or *Marcaſite* be mix'd with *Bitumen*, and the *Spirit* of *Nitre*, or *Aqua Fortis*, intirely depurated from all its *Phlegm*.

And thus I have ſhewn how Death may enter at the Noſtrils, tho' nothing properly *Venomous* be inſpired. It were perhaps no difficult Matter to make it appear, how a leſſer Degree of this Miſchief may produce Effects, tho' ſeemingly very different from theſe now mention'd, yet in reality of the ſame Pernicious Na-

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(*c*) Vid. L. di Capoa Moſet. *pag*. 40.
(*d*) *Pag*. 128.

ture; I mean, how ſuch an alteration of the common Air as renders it in a manner *Mephitical*, that is, increaſes its *Gravity*, and leſſens its *Elaſticity*, (which is done by too much Heat, and at the ſame time too great a Proportion of watery and other groſſer Particles mixt with it) may be the Cauſe of *Epidemick* Diſeaſes, and, it may be, more eſpecially of thoſe, which by Reaſon of their untoward Symptoms, are uſually call'd *Malignant*.

For it is very Remarkable, that *Hippocrates* (*a*) obſerved the Conſtitution of the Air, which preceeded *Peſtilential* Fevers, to be great *Heats*, attended with much *Rain* and Southern Winds; and *Galen* (*b*) takes Notice, that no other than a *moiſt* and *hot* Temperament of the Air brings the *Plague* it ſelf; and that the Duration of this Conſtitution is the Meaſure of the Violence of the Peſtilence. *Lucretius* (*c*) is of the ſame Mind, for in his admirable Deſcription of the *Plague* of *Athens*, Theſe

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(*a*) Epidem. *l.* 2, & 3.

(*b*) De Temperament. *l.* 1. *c.* 4. & Commentar. in Epidem. *l.* 3.

(*c*) L. 6. *v.* 1098.

Diſeaſes,

Diſeaſes, ſays He, *either come from the Air, or ariſe from the Earth,*

> ——*Ubi* Putrorem humida *nacta eſt*
> *Intempeſtivis* Pluviiſq; *&* Solibus *icta.*

In ſhort, the general *Hiſtories* of *Epidemick* Diſtempers do almoſt conſtantly Confirm thus much, and would have done it more, if the vain Notion of *Occult Venoms* had not prepoſſeſs'd the Minds of Authors, and made Them regardleſs of the manifeſt Cauſes.

And This is notorious enough in theſe Countries where *Malignant* Diſeaſes are moſt rife; Thus it is a very common Obſervation in the *Eaſt-Indies*, that during the dry Heats the Seaſon is Healthful, but when the Rains fall immediately upon the Hot Weather, then *untoward Fevers* begin to threaten.

The ſame is obſerv'd in *Africa*; for (as *Joan. Leo* (*d*) relates) if *Showers* fall there during the Sultry *Heats* of *July* and *Auguſt*, the *Plague* and Peſtilential Fevers inſue thereupon, with which whoſoever is infected hardly eſcapes.

(*d*) Hiſtor. Afric. *l.* 1. c. 1. Vid. Purchas's *Pilgrims*, *l.* 6. c. 1.

And here I might, by Reflecting on the Uſe and Neceſſity of *Reſpiration*, and the particular manner of performing It, (of which I have hinted ſomething already) and conſidering withal the true Nature of *Fevers*, eaſily ſhew how ſuch a Conſtitution of the Air, as this is, muſt neceſſarily produce ſuch Effects ; might run over the *Propoſitions* of *Bellini* ; which *as* they do plainly evince *Malignant* and *Peſtilential Fevers* to be owing to a viſcid and tenacious *Lentor* or Slime, which at firſt obſtructs the Capillary Arteries, and afterwards being diſſolved by Heat, Ferments with the Blood, and changes it into a Maſs unequally Fluid and Glutinous, and therefore unfit for all the Operations of the Animal Oeconomy ; *ſo* it would be no uneaſie Task to prove, that Air at the ſame time *Hot* and *Moiſt*, being leſs able to comminute and break the Arterial Fluid in the *Lungs* than is neceſſary, in order to prepare it for Secretions, it is no wonder, if when the Blood paſſing thro' the Capillary Veſſels arrives at the Secretory Organs, the Cohæſion of its Parts not being ſufficiently removed, inſtead of deriving ſeveral Juices out of it into the Glands, it leaves its moſt Glutinous and Viſcid Parts ſticking about the Orifices of theſe Veſſels; which tho' they may at firſt be waſh'd away by the repeated Impulſes of the ſucceeding Blood, yet the Cauſe continuing, and theſe Strokes growing ſtill Weaker and Weaker, (from a leſſer quantity of Spirits being ſeparated, and hence a more languid Contraction of the Heart) Theſe Obſtructions are increas'd to that Degree as not to be remov'd, till by the Violent Agitation of a greater Heat, this *Slimy Mucus* is thrown into the Blood again, and there in the Nature of a *Ferment* ſo diſturbs its *Mixture*, and changes its *Compages*, as to make it a Fluid of quite different Properties, that is, altogether unfit for the ſame Fonctions or Offices.

This Effect will be the more certain, becauſe a damp Air upon the ſurface of the Body checks inſenſible Perſpiration, ſo that a great quantity of this being detained, the Obſtructions are ſtill greater in the ſmall Tubes; whereas indeed upon the Account of a more than ordinary Heat, this Diſcharge ought now to be in an increaſed Proportion.

Such a Diſpoſition of the Blood as this the Ancients call'd *Putrid*; and to ſpeak plainly, it is a Beginning Stagnation, with a Succeeding Heat and Fermentation.

Nor would it be amiſs here to take notice, how unjuſtly ſome Authors, having quitted the Conſideration of *plain Cauſes*, for *Occult Venoms* and *Deleterium quid*, have brought in the ϑεῖον τὶ (*ſomething Divine*) of *Hippocrates* (*e*) to favour their fond *Hypotheſis*; tho' His beſt Interpreter *Galen*, underſtood by this Expreſſion no ſuch thing as they mean; but on the other Hand, only the *manifeſt Conſtitution of the ambient Air*, ſuch as himſelf has deſcribed in his *Aphoriſms* (*f*), and which is exactly the ſame with That We have bin diſcourſing of.

And therefore not only does *Minadous* (*g*) rightly Remark, that in his whole *Epidemicks*, *Hippocrates* never once mentions any *Venom* or Poiſon as the Cauſe of *Malignant* Diſeaſes; But the Divine Old Man himſelf in another *Treatiſe* (*h*) expreſly teaches Us, that *All Maladies do equally, or one as much as another, proceed from the Gods, there being nothing more Divine in this than in that, each acknowledging its own Natural and Manifeſt Cauſe.*

(*e*) Prognoſtic. 1. & Galen. Comment.

(*f*) *Sect.* 3. *Aph.* 11.

(*g*) De Febre Malign. *l.* 1. *c.* 11.

(*h*) De Aere, Locis, & Aquis.

But I willingly wave inſiſting upon theſe Heads, as well as the Hints which might be taken from this Theory, of ſome Uſe perhaps in the Cure of theſe Diſtempers; And leave it to our Phyſicians to judge upon how good Grounds They do, in Caſes of this Nature, under the Notion of *Alexipharmicks*, give ſuch Medicines as raiſe a great Heat both in the Stomach and Blood; only praying Them to take Care, leaſt while They are ingaging the Animal Spirits in War with *Malignities*, They do ſend treacherous *Auxiliaries* to the ſuppoſed weak *Party*; that is, that they either raiſe new Tumults and Diſorders of worſe Conſequence than the Original Miſchief; or at leaſt, by clogging the Wheels, and throwing Duſt upon the Springs of the fineſt Machine in the Creation, do check and interrupt the Action of Nature (*i*), when 'tis imploy'd about the moſt Nice and *Critical* Work.

Neither can I, tho' an occaſion be fairly offered, by any means be induced to intermeddle in the Controverſie of thoſe Gentlemen, who by the help of Two Words are made Maſters both of Philoſophy and Phyſick; I mean, the Vio-

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(*i*) Φύσιες Νούσων ἰητροί. Hippocr. *Epid.* 6.

lent Aſſertors of *Acid* and *Alkali.* Theſe ſcanty Principles fall infinitely ſhort of that vaſt Variety there is in the Works of Nature; However, for Their Sakes who are as yet Advanc'd no farther, I will adviſe the Contending Parties, (becauſe little good is got by Quarrelling) to Think of an Union, and if They can find no Remedies but out of theſe Two Tribes, to make Uſe of ſuch as reſult from a prudent Mixture of ſome out of Each. If this *Project* does not take, to Reſolve however on both ſides, To Diſtinguiſh the differing Times of the ſame Diſeaſe, and know, that *as*, on the one Hand, *Acid* Medicines are oftentimes as certainly hurtful in the latter End, as they do ſervice in the Beginning of the Fever; *ſo*, on the other, thoſe which are *Alcalious* muſt neceſſarily for the ſame Reaſon do miſchief in the firſt Periods, for which they are profitable in the laſt Days of the Diſtemper.

By what Mechaniſm this comes to paſs They will eaſily underſtand, when they have learn'd what Alteration ſuch things as theſe are do make in the humane Body; nor will it then be a difficult Matter to convince Them, That He is equally a fond Slave to an *Hypotheſis*, who becauſe

Acids are ſometimes of great Service in Fevers, concludes that their Origine is *Alcalious*; as He who knowing that Stagnating and Fermenting Juices do eaſily turn to *Acidity*, from thence Argues that *Alcalies* are the only Cure of this Stagnation and Ferment.

But Dr. *Pitcarne* (*k*) has abundantly demonſtrated the Weakneſs of Theſe Mens Reaſonings, and the Vanity of ſuch Immechanical Theories.

And here I would put a Period to this Part of the Diſcourſe, were it not that theſe Diſtempers being ſometimes *Contagious*, and *Contagion* being juſtly reputed a real *Poiſon*, it may be worth the while to examine a little what This is, and wherein it conſiſts; more eſpecially, becauſe ſome may perhaps be apt to think This to be an Argument of an *Occult Venom*'s being the Firſt and Original Cauſe.

We are therefore to take Notice, that when a *Fever* is communicated by way of *Infection* from one already Diſeaſed, this moſt commonly happens in the latter End of the Diſtemper, that is, (as we before diſcourſed concerning the *Hydrophobia*)

(*k*) Diſſertatio de opera quam præſtant corpora acida vel alcalica in Curatione Morborum.

when the Fermenting Blood is throwing off great quantities of its Active Fermentative Particles upon the Glands of the moſt conſtant and eaſie Secretion; ſuch are thoſe in the Surface of the Body, and the Mouth and Stomach; By this means therefore the Liquid of inſenſible Perſpiration, and the Sweat is impregnated with theſe μιάσματα, and thus the ambient Air becomes fill'd with 'em; ſo that not only, (as *Bellini* Argues (*l*),) may ſome of theſe *Effluvia* inſinuate themſelves into the Blood of a ſound Perſon thro' the Pores of the outward Skin, but alſo in Inſpiration thro' the Membrane of the Lungs; for He has in another Place (*m*) demonſtrated how the Air, or ſomething from It, may this way come to be mix'd with the Arterial Fluid; And thus the like *Ferment* will be rais'd Here, as was in the Originally Diſtempered Subject.

This may be *One*, but there is perhaps *another*, yet more dangerous manner of *Infection*, and that is, by the Breath of the Diſeaſed taken in by a By-ſtander, eſpecially in the laſt Moments, ſeizing the *Stomach*, and fixing a *Malignity* There.

(*l*) De Febrib. *Prop.* 27.
(*m*) De Motu Cordis, *Prop.* 9.

For it is upon this Score, that Thoſe who are *Infected* do preſently complain of an extreme Pain and *Nauſea* in the upper Orifice of the Stomach; and that all Authors do agree in the admirable Uſe of *Vomits* timely given in this Caſe; Theſe by their Stimulating Force removing the very *Minera* of the Diſeaſe; and likewiſe that, oftentimes in *Peſtilential* Illneſſes, the *Stomach* when opened has bin found Gangren'd and Mortify'd. This made *Van Helmont* (*n*), who had obſerved this Part in one kill'd by a *Plague Infection*, perforated and eroded in ſeveral Places, no otherwiſe than He had ſeen in one Poiſon'd by *Arſenick*, conclude, that the Plague for the moſt Part begins in the Stomach from a coagulated *Tartar* there.

Herein lyes the difference of *Contagion*, from the firſt Invaſion of Malignant Diſtempers; The Effects of the *One* are the Cauſe and Beginning of the *Other*; and therefore it is no wonder, if tho' the Symptoms in the former are by a gradual Increaſe wrought up to their height, they do however in the latter, even at the very firſt, diſcover their ill Nature and Vio-

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(*n*) Tumulus Peſtis, *pag. m.* 163, *&* 172.

lence, and, like a reinforc'd Enemy, by ſurer Strokes make quicker Diſpatch. And this alſo is the Reaſon of the great Increaſe of *Funerals* in Plague Time, in that One Death is thus added to Another.

If it be difficult to explain the particular manner how the *Stomach* comes to be thus affected, We muſt not therefore deny Matter of Fact; and may however probably Conjecture, that the laſt *Breath* of one Dying of a Malignant Diſtemper proves thus pernicious, in that Theſe fermenting active Particles which, as we juſt now obſerv'd, the Blood diſcharges upon the Glands of the *Mouth*, *Stomach*, *Lungs*, &c. impregnating the Air in its Paſſage thro' theſe; when the ſame happens to be immediately inſpired by a ſound Perſon, it may eaſily taint the *Salival* Juices in the Mouth, which are very Glutinous, and of a fermenting Nature, and therefore ſuſceptible enough of *Contagious Effluvia*, but eſpecially of ſuch as proceed from the ſame Liquor infected in the Sick Party. Now the *Spittle* is continually ſwallowed down into the Stomach, and ſo will quickly impreſs its *Labes*, or ill Quality, on ſo tender and ſenſible a Part; that is, will lodge theſe

Corroſive *Salts* (for ſuch We may ſuppoſe the Particles of Infection) in the Secretory Ducts; whereupon the Glands being obſtructed, little *Tumors* are by the afflux of their Fluid rais'd here and there, which breaking become ſmall *Ulcers*, and produce that diſmal Train of Symptoms which we have already related.

And here it may not be amiſs to take notice, that all Authors do agree, One great Cauſe of *Peſtilential* Diſtempers, eſpecially in Armies and Camps, to be dead Bodies lying expos'd and rotting in the open Air; The Reaſon of which is plain from what we have bin advancing; For Battels being generally fought in the Summer Time, it is no wonder, if the Heat acting upon the unbury'd *Carcaſſes*, and *Fermenting* the Juices, draws forth thoſe active Particles, which in great quantities filling the Atmoſphere, when they are inſpired and let into the Stomach, do affect It after the manner already deſcribed.

To illuſtrate this Matter, I ſhall relate a remarkable Story told Me by the learned Dr. *Baynard*. The Body of a Malefactor was Hung up in Chains in the Country; after a few Months, in very hot Weather, it was Sport and Paſtime to ſome Boys Playing thereabouts to Swing the Carcaſs up and down; One more bold than the Reſt ſtruck It with his Fiſt upon the naked Belly, which being outwardly parch'd and dry, and from the falling down of the Humours Swell'd and Tenſe, was eaſily burſt by the Blow; out guſh'd a Water ſo Corroſive and Fiery, that running down the poor Lad's Arm, it caus'd a Violent *Excoriation*, and a very hard Matter it was to preſerve It from being truly mortified. What this *Serum* could do upon the outward Skin, the more Volatile Parts of It would, without all doubt, Effect upon the more tender and ſenſible Membranes of the *Stomach*, if a conſiderable number of 'em were fixt there. The Fluids of Humane Bodies being Ranker and more abounding in active Salts than thoſe of other Creatures, which are not continually repaired and nouriſh'd by the Juices of Animals.

The Way by which *Bad Food*, *ill ripened Fruits* of the Earth, *&c.* do oftentimes produce *Malignant* and *Peſtilential* Diſeaſes, is not very different from *That* by which We have obſerved Unwholeſome Airs to be the Cauſe of the like Effects. For the Juices with which Thoſe do ſupply the Blood being Corrupted, muſt neceſſarily make a Fluid of quite other Properties than what the Animal Oeconomy requires, that is, neither Fit for Nutrition, nor for the Secretion of thoſe Liquors which in the ſeveral Organs are to be derived from It; whereupon the ſmall *Tubes* are obſtructed by an unequally Glutinous *Slime*; and it is therefore no wonder, if beſides the other Symptoms inſuing, *Sore Puſtules*, *Inflammations*, *Ulcers*, &c. (more common in Fevers from this Cauſe than in any other,) are raiſed in the Surface of the Body.

This is the Ground of the common Obſervation, that a *Famine* is very often ſucceeded by a *Peſtilence*. And This *Calamity* generally begins among the Poorer ſort of People, whoſe Diet to be ſure is the worſt.

The City of *Surat* in the *Eaſt-Indies* is ſeldom or never free from the Plague; and yet it is obſerved, that the *Engliſh* who Trade there are in no danger of being Infected thereby. Now the Chief of the Natives in this Place are *Banians*, who neither Eat Fleſh, nor Drink Wine, but Live very Poorly upon *Herbs*, *Rice*, *Water*, &c. and moſt of the Inhabitants do the like, except Foreigners; This Poor Fare, together with the Heat of the Climate, makes them ſo liable to Malignant

Diſtempers; from the Attacks of which Thoſe who Feed well are more Safe and Secure.

Thus much concerning *Poiſonous Exhalations and Airs*, ſo far as the Conſideration of the *Grotta de' Cani* has led Us on to enquire into their Effects; for tho' there may be other Alterations of this ſame Element, differing in their Nature from this we have inſiſted upon, and yet equally Pernicious and Hurtful, yet We take no Notice of any of them, in regard that thoſe which are from *Arſenical*, *Mercurial*, and the like *Fumes*, are reducible to a foregoing *Eſſay*; and thoſe which are owing to a Change of the known Properties of the Air, may be eaſily explain'd by what has bin already delivered in *This*. I ſhall therefore rather chuſe to make ſome Remarks on the Miſchief of another *Fluid*, which *as* It is next in uſe to This we have bin treating of, *ſo* the bad Qualities of it, when it comes to be altered, muſt neceſſarily be almoſt equally Fatal and Dangerous.

I mean *Water*, which is of ſo conſtant Service, not only for our Drinks, but alſo in preparing of our Fleſh and Bread, that it may juſtly be ſaid to be the *Vehicle* of all our Nouriſhment; ſo that whenever this happens to put on other Properties than are neceſſary to fit it for this Purpoſe, it is no wonder if in its Paſſage thro' the Body theſe do make ſuitable Impreſſions there.

Thus at *Paris* (o), where the Water of the River *Seine* is ſo full of Stony Corpuſcles, that even the Pipes thro' which they it is carried, in time are incruſted and ſtopt up by 'em, The Inhabitants are more Subject to the *Stone* in the Bladder than in moſt other Cities. The ſame I obſerved in the *Baths* of *Abano*, a few Miles from *Padua*, to that Degree, that it is neceſſary very frequently to clear the Wheel of a Mill driven by the Current of theſe Springs, from the great quantity of *petrify'd* Matter with which it is from time to time incumbered.

In like manner, let the groſs Particles with which the *Water* is ſaturated be of any other Nature, *Metallick*, *Salts*, &c. theſe, according to their various Gravity, the Capacity of the Canals, and ſuch like Circumſtances, will, when they come to circulate in the Animal Body, be by the

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(o) Vid. Liſter's *Voyage to* Paris.

Laws of Motion depoſited in one Part or other. So thoſe Mineral Bodies, and Nitrous Salts, which abound in the Snowy Waters of the *Alps*, do ſo certainly Stuff and Inlarge the Glands of the Throat in Thoſe who Drink 'em, that ſcarce any who live there are exempted from this Inconvenience (*a*).

For this Reaſon, the Choice of *Water* for Drink among the Ancients was by Weight, the lighteſt being preferr'd, as moſt free from all Heterogeneous Bodies.

The Caſe therefore of *Poiſonous Springs* is, their having Corroſive Corpuſcles mixt with their Water, which cannot fail when forſaken in the Canals of the Body of their Vehicle, to do the ſame miſchief as they would if taken by themſelves undiluted; only with this difference, that they may in this form be carried ſometimes farther into the Animal Oeconomy, and ſo having paſs'd the *Primæ Viæ*, diſcover their Malignity in ſome of the inmoſt Receſſes. Thus the *Fons Ruber* in *Æthiopia* mention'd by *Pliny* (*b*), about which abundance of

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(*a*) Quis tumidum Guttur miratur in Alpibus. *Juvenal Satyr.* 13.

(*b*) *Lib.* 31. *cap.* 2.

native *Minium* or *Cinnabar* was found, ſhew'd its ill Effects chiefly on the Brain; and therefore *Ovid* (*c*) ſays of it,

——Si quis Faucibus hauſit
Aut Furit aut patitur mirum gravitate Soporem.

We ſhall not need then to inlarge on this Matter, ſince any of the foremention'd *Mineral Poiſons* may thus impart their deadly quality to Waters; and accordingly there are Inſtances of *Arſenical*, *Mercurial*, &c. Fountains, of which the Hiſtories may be ſeen in the Collections of the Learned *Baccius* (*d*). And one very remarkable in the *Philoſophical Tranſactions* (*e*).

But as We before took Notice concerning *Airs*, ſo it may be worth the while to obſerve of *Waters*; that there are ſome Alterations of them, which tho' not properly *Poiſonous*, yet are of ſo great Conſequence in their Effects, that they may very well deſerve to be regarded.

This I ſhall do with reſpect to a great Abuſe, committed in this kind about the

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(*c*) Metam. *lib.* 15.
(*d*) De Therm. *lib.* 6.
(*e*) No. 8.

City; and that is, In the chuſing of ſtagnating impure *Well-Water* for the *Brewing* of *Beer*, and making other Drinks. Such a Fluid indeed has oftentimes a greater Force and Aptneſs to extract the Tincture out of *Mault*, than is to be had in the more innocent and ſoft Liquor of Rivers; but for this very Reaſon it ought not, unleſs upon meer Neceſſity, to be made uſe of; this quality being owing to the *Mineral* Particles and *Aluminous* Salts with which it is impregnated.

A late *Author (f)* by ſearching into the firſt Accounts of the Diſtemper we call the *Scurvy*, deſcribed by *Pliny (g)* and *Strabo (h)*, under the promiſcuous Names of *Stomacace* and *Scelotyrbe*; and examining the Authentick Hiſtories of It in later Years, made by the moſt obſerving Phyſicians in thoſe Countries where it was unhappily revived, as *Olaus Magnus*, *Balduinus Ronſeus*, *J. Wierus*, *Solomon Albertus*, &c. finds that the Origine of It was in all times and places charged upon the uſe of unwholeſome ſtagnating *Waters*. Then by comparing together the

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(f) *Dr.* J. H. Scelera Aquarum: *Or, a Supplement to Mr.* Graunt *on the Bills of Mortality.*

(g) *Lib.* 25. *c.* 3.

(h) Geogr. *lib.* 6.

Clayie Strata of the Earth about the Cities of *London*, *Paris*, and *Amſterdam*, He ſhews that where the Water is worſt, there this Malady is moſt rife. So that He has put it out of all doubt, that moſt of the perplex'd and complicated Symptoms which are ranged under this one general Name, if they do not entirely owe their Birth to the Malignity of this Element, do however acknowledge it to be their main and principal Cauſe.

And indeed *Hippocrates* himſelf, as He has very plainly decipher'd this *Diſeaſe* (*i*), by the Title of σπλῆνες μέγαλοι, or *great Milts*; ſo he does very particularly in another *Treatiſe* (*k*), take notice, that Drinking of *Stagnating Well-Waters* muſt neceſſarily induce an ill Diſpoſition both of the *Milt* and Belly.

If we enquire into the Reaſon of ſuch ill Effects, we muſt conſider, that *Clay* is a *Mineral Glebe*, and that the groſs Particles and Metallick Salts with which Waters paſſing thro' ſuch a Bottom do abound, are, as Dr. *Liſter* (*l*) obſerves,

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(*i*) Prorrhet. *l.* 2. *c.* 16.

(*k*) De Aere Aquis & Locis, ſub finem.

(*l*) De Fontib. Med. Angl. P. 2. *pag.* 75. At foſſilia ſive Metallica ſalia alia atq; alia ſunt, & nobis & pene igni dixeram indomabilia.

not to be maſtered, that is, indigeſtible in the Humane Body. Not only therefore will theſe Cauſe, as He very well Argues, calculous Concretions in the *Kidneys*, *Bladder*, and *Joints*; and as *Hippocrates* experienced, hard Swellings in the *Spleen*; but they muſt neceſſarily oftentimes by their Corroſive quality twitch and irritate the ſenſible Membranes of the Stomach and Bowels, and thus hinder and interrupt the Digeſtion of our Food. Nay, beſides all this, when they come into the Blood, it is no wonder if the ſmall Canals of inſenſible Perſpiration are frequently ſtopt and obſtructed by 'em; for it is upon this Score that *Sanctorius* (*m*) teaches Us, that *heavy Water converts the Matter of Tranſpiration into an* Ichor, *which being retained, induces a* Cachexy.

What Miſchiefs will inſue hereupon every one ſees; not only Pains in the Limbs, livid Spots in the Surface of the Body, Ulcers, *&c.* from the Acrimony of the undiſcharged Moiſture; but many beſides of thoſe perplexing Symptoms which go by the Name of *Hyſterical* and *Hypochondriacal*, may take their riſe from

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(*m*) Medicin. Static. *Sect.* 2. *Aphor.* 6.

the ſame Source; for the before cited *Sanctorius* (n) has remark'd, that the *Flatus or Wind* ſo inſeparable from thoſe Caſes, is no other than *the Fluid of Perſpiration rude and unfiniſhed.*

If theſe Inconveniencies are oftentimes not felt, at leaſt not till towards the declining Age, in ſtrong and active Habits of Body; yet I am, from very good Experience, aſſured, that they deſerve Conſideration in weaker Conſtitutions, and a Sedentary Life, eſpecially of the more tender Sex.

I have the honour to be nearly related to a worthy Perſon, who led formerly an afflicted Life from the frequent returns of Violent *Colick Pains*, till ſhe was with happy Succeſs adviſed by the Noble *Van Helmont* not to Drink (as ſhe then did) Beer Brewed with *Well-Water*; and her Health is even now ſo far owing to this Management, that an Error in It is unavoidably follow'd with the wonted Complaints.

For theſe Reaſons *Pliny* (o) tells Us, that *Thoſe Waters are Condemn'd in the firſt*

(n) Ibid. *Sect.* 3. *Ap.* 13. Flatus nil aliud eſt quam rude perſpirabile.

(o) *Lib.* 31. *c.* 3. Damnantur imprimis Fontes quorum Aquæ decoctæ craſſis obducunt Vaſa cruſtis.

Place which when Boiled do incruſtate the ſides of the Veſſels; And that our *Well-Waters* do this, no Body who looks into the *Tea-Kettles* of our Gentlewomen can be Ignorant.

And indeed in Ancient Times, when Phyſick was more a Science, which is now more a Trade, as that Part of It which relates to *Diet* was more carefully ſtudied, than it is Now-a-days, ſo this Point particularly of which we are Treating was of ſo great Moment, that *Hippocrates*, who wrote the beſt Book (*p*) on the Subject that ever was Publiſh'd, has in a great Meaſure accounted not only for the Diſeaſes, but even for the Temper and Diſpoſition of the People of ſeveral Countries, from the Difference of the *Waters* with which Nature has ſupplied Them.

(*p*) De Aere, Locis, & Aquis.

FINIS.

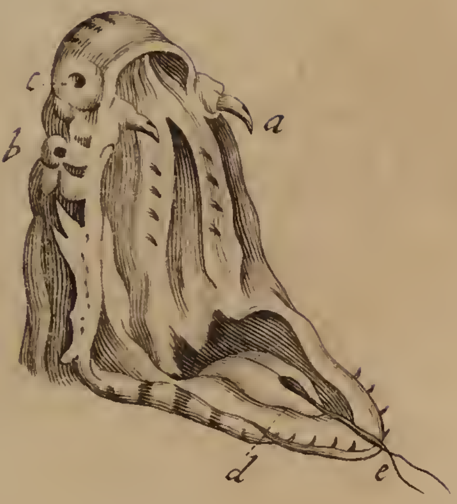
The Explication of Thoſe Figures which are not Explained in the Treatiſe.

FIG. 1. Repreſents the Head of the *Viper* in its Natural Bigneſs, with the Mouth open, and Fangs Erected.
(*a*) Marks the Poiſonous *Fang.*
(*b*) The Eye.
(*c*) The Hole of one Noſtril.
(*d*) The *Larynx.*
(*e*) The Forked Tongue.

All the Other Figures relating to the Viper *are drawn larger than the Life.*

Fig. 7, & 8. Exhibit ſome Muſcles which ſerve for the Motion of the Jaws.
(*a Fig.* 7.) *Elevator Maxillæ Inferioris.*
(*b*) *Depreſſor ejuſdem.*
(*c*) *Depreſſor Dentis Venenoſi.*
(*d*) A Strong Ligament faſtened by one Extremity to the Spinal *Apophyſis* of the Second *Vertebra* of the Neck, and by the other to the end of the *Elevator Maxillæ Inferioris.*
(*a Fig.* 8.) A Muſcle which, being fixt to the Extremity of both Jaws, ſerves to pull them backwards, and may be called *Retractor.*
(*b*) The Internal ſide of the *Depreſſor Dentis Venenoſi.*
(*c*) *Elevator Dentis Venenoſi.*
(*d*) The Extremity of the Lower Jaw.
(*e e*) *Flexores Capitis.*
(*f*) The Internal Part of the Skin covered with ſome Muſcular Fibres.
Fig. 17. Shews the Head of the *Scolopendra.*
(*a a*) The Wounding Claws.
(*b*) The Mouth.
(*c c*) The Two Firſt Feet.
Fig. 18. The Weapons of the *Nhamdu* in their Natural Bigneſs.

Fig: 1.



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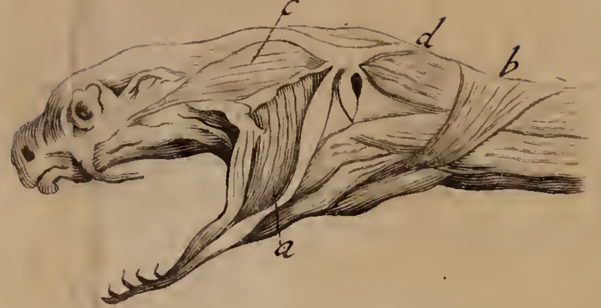

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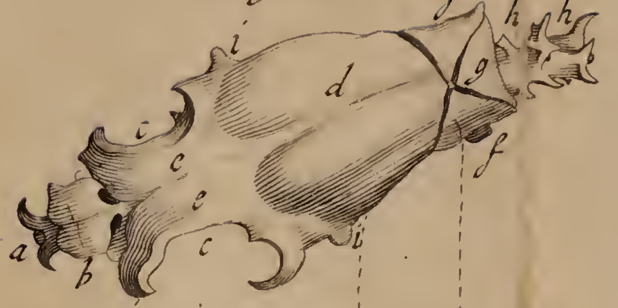

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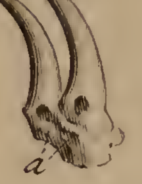

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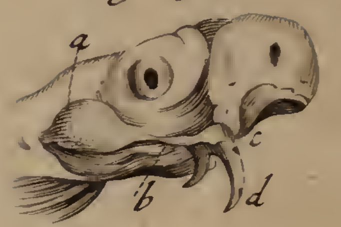

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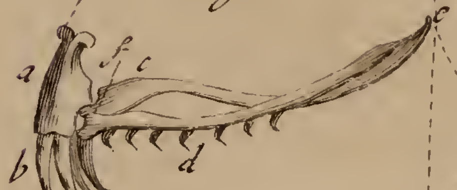

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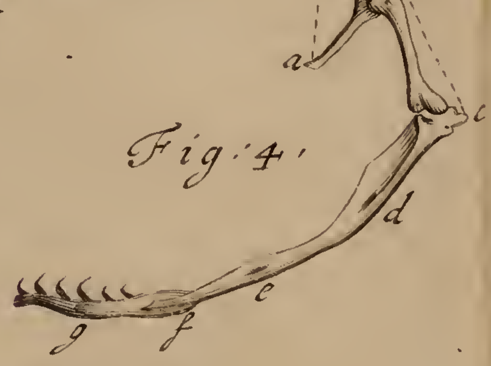

Fig: 6.

Fig: 12.

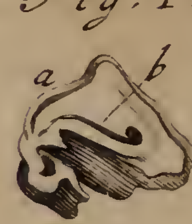

Fig: 11

Fig: 10.

Fig: 8.

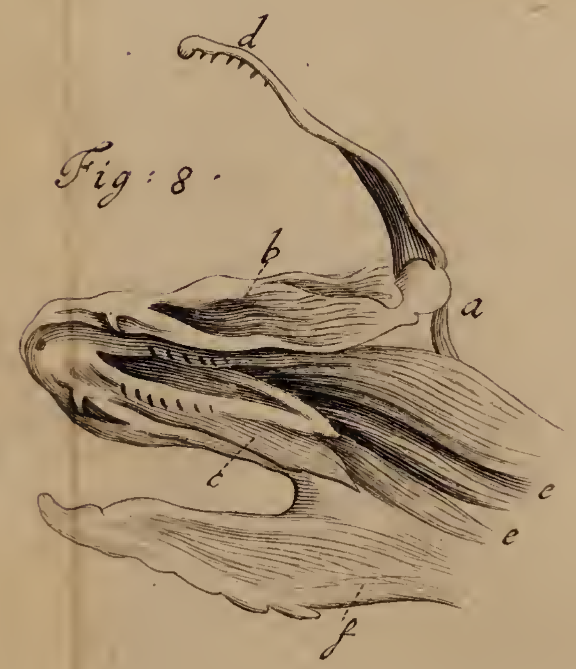

Fig: 13.

Fig: 14.

Fig: 15.

Fig: 19.

Fig: 18.

Fig: 17.

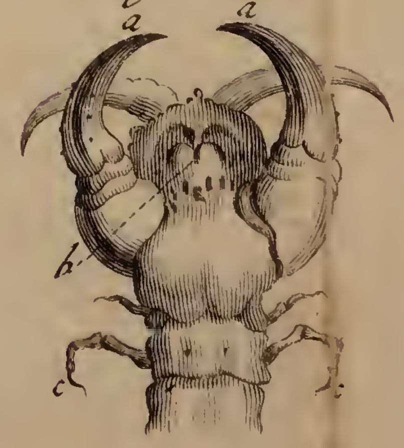

Fig: 16.

M. vander Gucht Sculp.